

FLIGHT

The
AIRCRAFT
ENGINEER
&
AIRSHIPS

First Aero Weekly in the World

Founder and Editor: STANLEY SPOONER

A Journal devoted to the Interests, Practice, and Progress of Aerial Locomotion and Transport

OFFICIAL ORGAN OF THE ROYAL AERO CLUB OF THE UNITED KINGDOM

No. 624 (No. 50, Vol. XII.)

DECEMBER 9, 1920

[Weekly, Price 6d.
Post free, 7d.]

Flight

The Aircraft Engineer and Airships

Editorial Offices: 36, GREAT QUEEN STREET, KINGSWAY, W.C. 2

Telegrams: Truditur, Westcent, London. Telephone: Gerrard 1828

Annual Subscription Rates, Post Free:

United Kingdom ... 30s. 4d. Abroad ... 33s. 0d.*

These rates are subject to any alteration found necessary under abnormal conditions and to increases in postage rates

* European subscriptions must be remitted in British currency

CONTENTS

Editorial Comment		PAGE
Aircraft or Battleships?	1247
British and French Air Policy	1248
The London-Paris Services	1248
Camera and the 'Plane: An Aerial View of Ghent	1249
London-Continental Services	1250
The Albatros Commercial Machine	1251
The Stout "Bat-Wing" Monoplane	1252
Royal Air Force Memorial Fund	1253
Notices to Airmen	1253
Airship Piloting. By Major G. H. Scott	1254
Airships from the Four Winds	1259
In Parliament	1261
The Royal Air Force	1262
Model Aeroplanes	1263
Sidewinds	1264

DIARY OF FORTHCOMING EVENTS.

Club Secretaries and others desirous of announcing the dates of important fixtures are invited to send particulars for inclusion in the following list:

Dec. 16 Lectures, "Possible Developments of Aircraft Engines," by Mr. H. Ricardo, and "The Instalment of Aeroplane Engines," by Mr. A. J. Rowledge, before R.Ae.S., at Royal Society of Arts

1921

Jan. 20 ... Lecture, "The Cost of Air-Ton-Miles, compared with other Forms of Transport," by Lord Montagu of Beaulieu, before R.Ae.S.

EDITORIAL COMMENT



THE question of the moment among the naval experts is that of aircraft and submarines *versus* the battleship and battle-cruiser. At the present moment we are faced with the doubtless unpleasant fact that within the next three, or certainly five, years our old-time naval supremacy will have passed to the United States, with Japan running a close race with us for second place. That is, if naval armaments are still to be judged by the number and power of the capital ships possessed by the several countries in competition for the lead. As an island Power, and particularly in view of the far-

flung character of the Empire, naval supremacy has hitherto been the beginning and end of our safety. Once the trident passed from our hands to those of another Power we could only look forward to existence by sufferance of the leading naval Power. This remains as true as ever it has been, but the question which is now being debated is whether or not the standard of comparison has completely changed? If it has not, and the capital ship remains the unit of comparison, then we must make up our minds to a building programme which, impoverished and over-taxed as we are, will strain our resources to the utmost. There is no way out—we must build to retain our supremacy at sea or live at the mercy of America and ultimately even of Japan.

It is not at all certain, however, that the capital ship still holds pride of place in the assessment of naval power. There is a very powerful school of naval thought which holds that it has in fact passed into obsolescence, and its place been taken by the submarine and aircraft. Without the slightest desire to pose as judges in so highly technical a question as this, we cannot refrain from venturing the opinion that those who think thus seem to have a good deal of reason on their side. Before the War, Sir Percy Scott created a sensation by laying down that the submarine was destined to drive the battleship from the seas. Lord Fisher, shortly before he died, went farther than this and said: "We've reached the epoch—prodigious in its advent—when positively the Air commands and dominates both Land and Sea." If Lord Fisher was right—and he is a bold man who would say without enquiry that he was wrong—it is quite clear that all our standards of naval power must be drastically revised. Indeed, it is not revision they require so much as complete revolution. We have in FLIGHT said the same thing in other words for years past, but then it may be advanced that we are prejudiced. This could hardly be laid to the credit of Lord Fisher.

There are some naval critics who actually look forward to the time—and that within the near future—when the navies of the world will be able to dive, to float and to fly. Lord Fisher did not go as far as this. He seems to have believed that the present battleship would be replaced by giant submersibles, assisted by clouds of aircraft. In the light of present knowledge it appears that he was nearer

right than those who are looking farther ahead. The giant submersible of which Lord Fisher spoke is merely a logical development of the "M" type of submarines which made their appearance towards the end of the War. These wonderful craft were actually armed with a 12-inch gun, so it is quite easy to foresee that the building of even greater submersible craft does not present any insuperable difficulty. If the present-day capital ship were replaced by numbers of such craft, together with numerous aircraft such as Lord Fisher visualised, it requires little imagination to see what might happen to an enemy's surface ships. We have only to recollect that over fifty destroyers were required to escort the damaged *Lion* into harbour after the Dogger Bank battle to arrive at some realisation of what the submarine menace was even at that comparatively early date. As we have said, it is not for us to here enunciate decided views on so vital a subject one way or the other, but we do think we are entitled to say that, having in view the wonderful developments which have been made in aircraft, and the probabilities of the future, that this question which is now being debated is of so uncertain and controversial a nature that the Admiralty will do well to sift and examine every vestige of evidence and opinion available before coming to definite conclusions as to its future building policy. At least we can and do urge that in any case, there must be no mistake made in not providing an adequate Air Force to act not only as the eyes of the Fleet, but for purposes of offensive against those mammoth ships of any possible enemies about which so much difference of opinion appears to exist just now.

British and French Air Policy

For many months past we have urged upon the Government that unless it could make up its mind to formulate a real aerial policy and to carry it out with promptness and despatch, the lead in the air with which we ended the War would disappear, and we should see other countries going ahead of us. It is, unfortunately, only too true that the Government has maintained its attitude of supineness, and now what we have prophesied has come to pass. We have only to look at France for verification of the outstanding fact that we have fallen behind in the race. Speaking at the Aero Club de France recently, M. Flandin, Under-Secretary for Aeronautics, said, and with truth, that France was in the front rank of the nations as regards aerial navigation, *especial progress having been made by the commercial services*. "We have today," he proceeded, "2,800 miles of routes regularly operated by French airmen. This result has not been equalled elsewhere. The services have been maintained with great regularity. On the Paris-Brussels route, of 360 flights announced 337 were successfully accomplished. The number of passengers carried has increased from 960 in 1918 to 6,750 in the first ten months of this year, while the mails have increased from 7 cwts. to 5 tons. *The cost to the State in subsidies has only amounted to £280,000.*"

The record is one of very substantial progress, and we would that a similar development had been shown in this country. France, with infinitely more foresight and imagination than has been displayed

by our own Government, quite early recognised the importance of commercial aviation, and, more than that, realised that if it was to be developed as it should be the State must come to its assistance until it had had a chance to find its feet and get going on its own resources. Therefore, the scheme of subsidies was evolved and put into execution, with the result that while British commercial aviation is languishing, its factories either closed down altogether or devoted to other purposes, and its technical staffs distributed to the four winds, France is going ahead rapidly. And all the progress our Ally has made has been achieved at a total cost to the State of very little more than a quarter of a million—a mere fraction of the sums which our own Government has wasted on chimerical schemes of "social reform" which nobody wants and which do no good except to the bureaucracy, for which they find well-paid jobs. There is another aspect of French progress which will bear glancing at for a moment. It is quite natural that when a Government is seen to be taking a really live interest in such an industry as aviation, private enterprise also is inclined to do very much more than it would otherwise attempt. This is true not only of the purely business side of things. Here in England we have a number of wealthy sportsmen, interested in aviation, who would undoubtedly do as much for the British movement as any were it not for the discouraging question to be asked: *Cui bono?* What is the use, they ask, of attempting to do things for a movement which has no apparent future? And so they keep their hands in their pockets. Now, one of the results of the direct encouragement extended to aviation by the French Government is that private individuals are taking a corresponding interest and are assisting to develop its future. We have an example of that in the recent offer by M. Deutsch de la Meurthe of a prize of 200,000 francs for a speed contest. That is a substantial sum of money for a single individual to provide for such a purpose. It is so well worth winning that it is very certain that it will stimulate design up to a point. Moreover, it is reasonably certain that such a prize would not have been forthcoming if the French Government's attitude towards commercial aviation had been of the same wet-blanket character as that of our own.

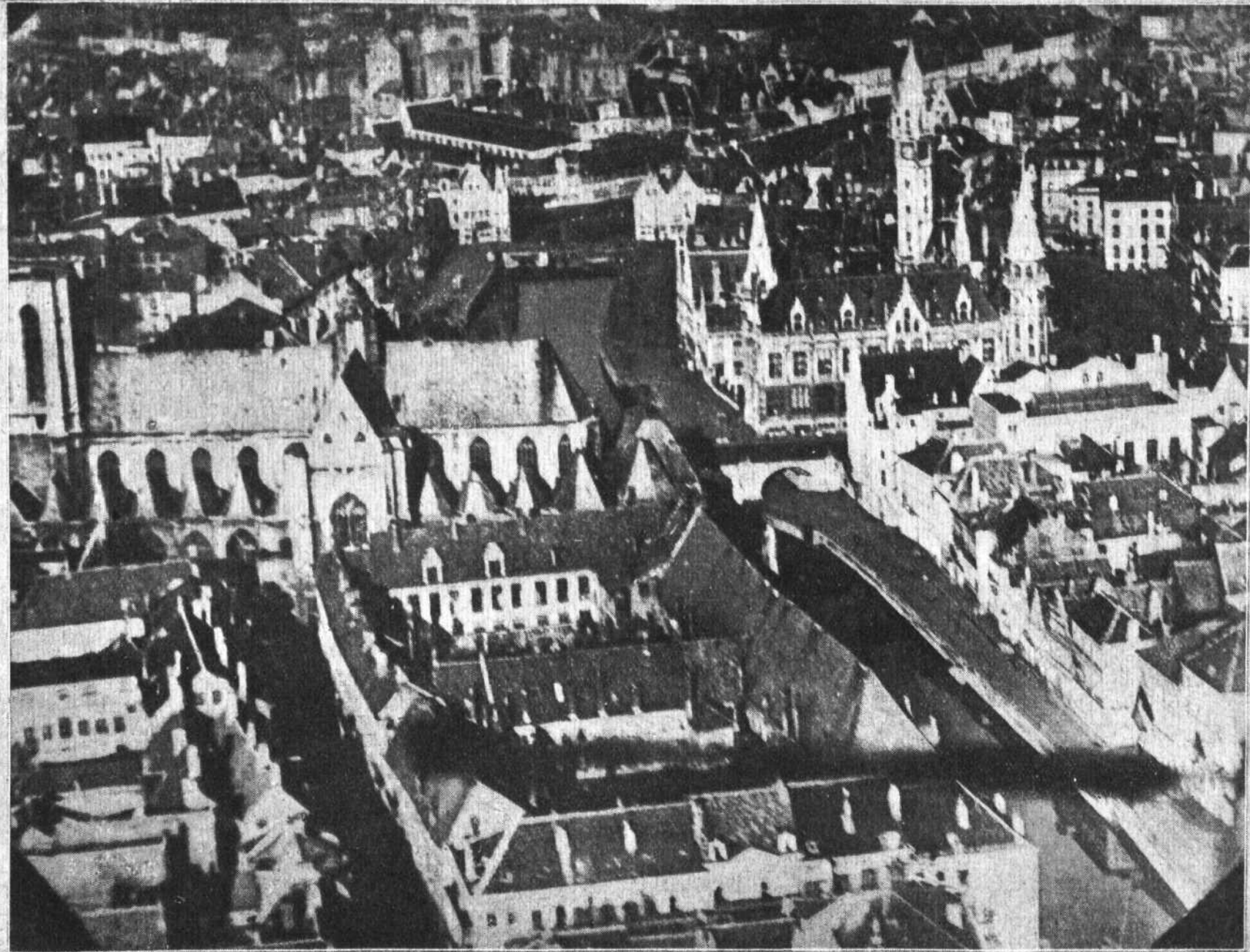
The London-Paris Services

There is unfortunately a possibility that the Airco service between London and Paris may cease operations at the end of the year. This is the service which has hitherto carried the very attenuated mails which the Post Office has thought fit to entrust to the new transport! It is believed that there is a strong hope that a new syndicate will be formed in time to take over and run the service, but at the moment all that can be said is that a decision was taken recently that, as the service does not pay on its present basis, it will possibly be better to wind it up and cease active operations.

The Airco service was inaugurated by Mr. Holt Thomas in August of last year. Its success was immediate, in so far as safety and regularity were concerned. In the first twelve months no fewer than 2,101 flights were made and 4,339 passengers carried. So far as the mail contract is concerned, this has

The Camera and the 'Plane

DECEMBER 9, 1920



An aerial view of the famous City of Ghent from a Handley Page aeroplane carrying passengers on the London-Brussels Air service. Travellers to the Continent by air have unique opportunities of viewing the famous towns of France and Belgium from the air.

really not done the Airco service a great deal of good. In the beginning, the extortionate fee of 2s. per letter charged by the Post Office kept traffic away, and even when, in September last, the fee was reduced the want of proper advertising by the postal authorities of the fact that letters can actually be accepted for air mail transmission has kept the service down to very narrow limits. It is said that better results could have been shown if the company could have scrapped the converted War machines with which its services were conducted and have adopted up-to-date commercial aeroplanes. The only satisfactory aspect of the whole matter is that the air mail is not likely to stop, even if it should be found impossible to get together a new syndicate to maintain the service. The Handley Page service is still to go on, and, although we understand that this firm has not so far been approached by the Post Office in the matter, it can hardly be doubted that the mails would be transferred to it in the event of the complete stoppage of the Airco line.

The news which is embodied in what we have already written is, we submit, eloquent testimony to the truth

of our utterances in our previous article on British and French ideas of Government encouragement. In France, as we have pointed out, the Government pursues a policy of direct encouragement of commercial flying—a policy which, as we have shown, is certainly not a ruinously expensive one, especially when its bearing on national defence is borne in mind. There the infant movement is growing rapidly and healthily. Here the Government cannot make up its mind to any sort of policy at all, with the result that aviation languishes. Private enterprise, which was willingly embarked upon after the Armistice on the word of the Government that it should be "encouraged," finds that without the promised assistance it cannot carry on. While France has her nearly 3,000 miles of active air route, and while Germany is going ahead fast in the development of civil flying, in spite of her disabilities under the Peace Treaty, we shall very shortly be left—unless the Airco service can be reconstructed—with but a single air route in operation, and that covered by a single company's service. It is an entirely melancholy reflection.

THE LONDON-CONTINENTAL SERVICES

FLIGHTS BETWEEN NOVEMBER 28 AND DECEMBER 4, INCLUSIVE

Route†	No. of flights*	No. of passengers	No. of flights carrying		No. of journeys completed†	Average flying time	Fastest time made by	Type and No. (in brackets) of Machines Flying
			Mails	Goods				
Croydon-Paris ...	12	16	4	10	11	h. m. 2 42	Airco 16 G-EALU (1h. 46m.)	A.16 (3), A.18 (2), B. (3), G. (2), H.P. (1).
Paris-Croydon ...	11	35	1	8	9	2 27	Airco 16 G-EAPM (2h. 10m.)	A.16 (3), A.18 (2), B. (2), G. (2), Sp. (1).
Cricklewood-Paris ...	1	2	—	—	1	1 48	Airco 4 G-EAVL (1h. 48m.)	A.4 (1)
Paris-Cricklewood ...	2	3	1	1	1	1 55	Airco 9 G-EAUN (1h. 55m.)	A.9 (2).
Croydon-Brussels ...	1	—	1	1	1	2 10	Airco 9 G-EATA (2h. 10m.)	A.9 (1).
Brussels-Croydon ...	—	—	—	—	—	—	—	Airco 9 G-EAPL made trip to Rotterdam and back.
Cricklewood-Brussels ...	1	—	1	1	0	—	—	A.4 (1).
Brussels-Cricklewood ...	4	1	4	4	1	2 40	Airco 9 G-EATA (20h. 40m.)	A.4 (2), A.9 (2).
Totals for week ...	32	57	12	25	24			

* Not including "private" flights.

† Including certain journeys when stops were made *en route*.

‡ Including certain diverted journeys.

A.4 = Airco 4. A.9 = Airco 9 (etc.). Av. = Avro. B. = Breguet. Br. = Bristol. Bt. = B.A.T.
F. = Fokker. Fa. = Farman F.50. G. = Goliath Farman. H.P. = Handley Page. N. = Nieuport. P. = Potez.
Sa. = Salmson. Se. = S.E.5. Sp. = Spad. V. = Vickers Vimy. W. = Westland.

The following is a list of firms running services between London and Paris, Brussels, etc., etc.:—Air Post of Banks; Air Transport and Travel; Co. des Grandes Expresses Aériennes; Handley Page Transport, Ltd.; Instone Air Line; Koninklijke Luchtvaart Maatschappij; Messageries Aériennes; Syndicat National pour l'Étude des Transports Aériens; Co. Transaérienne.

Honours

It was announced by the War Office on December 3 that among the decorations and medals awarded by the Allied Powers at various dates to the British Forces for distinguished services rendered during the course of the campaign was the following:—

CONFERRED BY HIS MAJESTY THE KING OF RUMANIA

Croix de Virtute Militara, 2nd Class

740 Ch. Master Mch. A. Taylor, 3rd Squadron Australian Flyg. Co.

Air Work in Euphrates Valley

THE following appeared in the *communiqué* issued by the War Office on December 1: "Our aeroplanes on November 26 attacked an insurgents' camp 8 miles north of Nasiriyeh."

Progress in France

SPEAKING at the Aero Club of France banquet on December 2, M. Flandin, Under Secretary for Aeronautics, said that whereas in 1919 the aggregate distance flown in France was 218,750 miles, the distance flown in the first ten months of this year totalled 937,500 miles. Likewise the number of passengers carried grew from 960 in 1919 to 6,750 in the ten months of this year, while the amount of mails carried increased from 9 cwt. in 1919 to well over 5 tons this year. The cost to the State in subsidies amounted to about £125,000.

He went on to say that there were now 2,800 miles of routes in France in regular operation. The ratio of accidents was one to every 62,500 miles flown, and the fatal accidents worked out to one for every 134,374 miles.

AN ALBATROS COMMERCIAL MACHINE

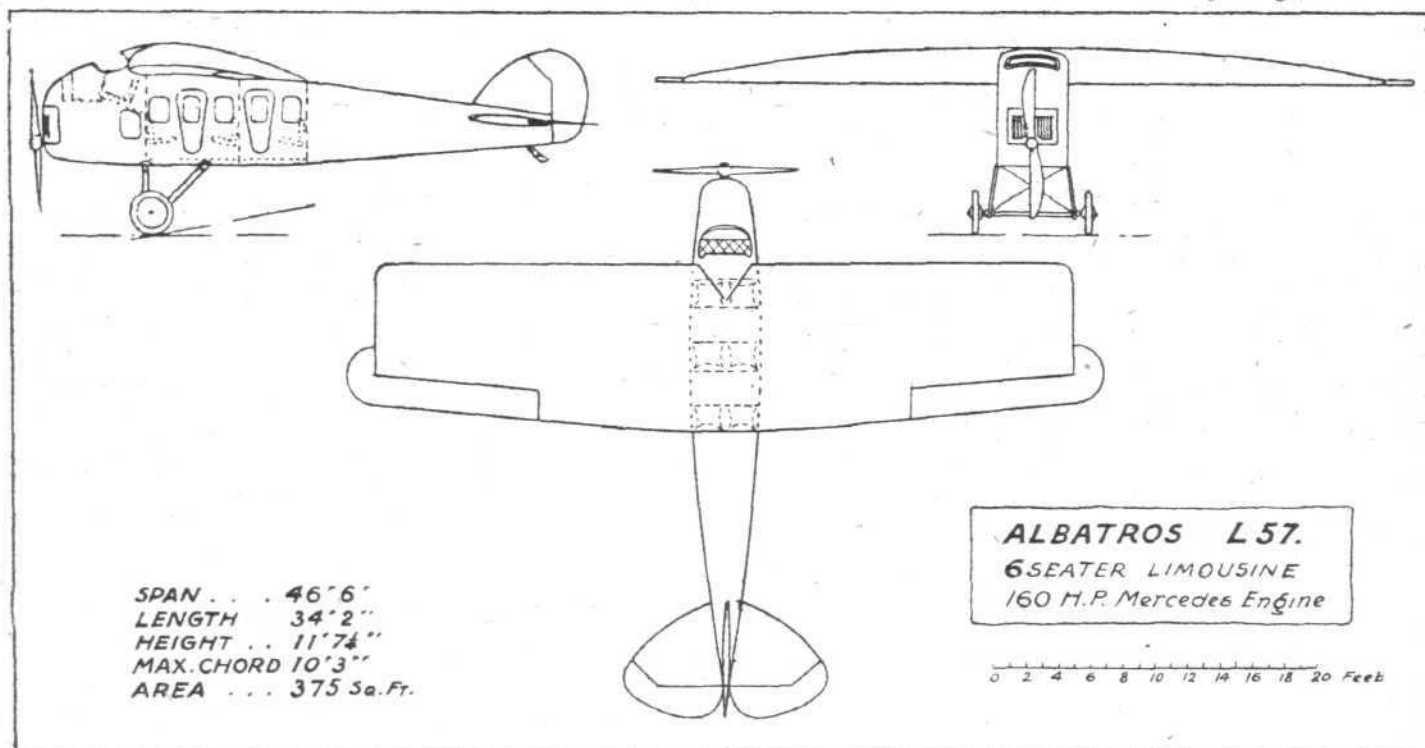
The "L. 57"

AMONG the firms which have succeeded in getting their commercial types of aeroplanes passed by the Allied Commission has not hitherto, so far as one is aware, been the well-known Albatros Company. This firm, as is, of course, well known, is one of the German pioneer firms, but during the latter part of the War its products were somewhat overshadowed by those of other makers such as Junkers, Fokker, Zeppelin, etc. It now appears that the Albatros firm is making a bid for a prominent place among the makers of commercial machines, as several new designs have been got out recently. Among these is that shown in the accompanying scale drawings. In some respects this machine is not unlike the Fokker which recently paid a visit to this country, piloted by Mr. Hinchliffe. It is a cantilever monoplane, with the pilot and engineer placed in front of the wing, and the passengers housed in a cabin under the wing.

Thus the general arrangement follows that of the Fokker. In detail, however, marked departures are found. Thus the front cockpit is placed much higher in relation to the wing,

aft, the remaining facing forward. Evidently the designer of the "L. 57" believes in ease of exit in case of emergency, as he has provided two doors in each side. This arrangement, incidentally, has the advantage of avoiding the usual space between seats, no central gangway being necessary. The seats are so arranged that they can be easily removed and the cabin space used for cargo. The space available is 9 feet 3 inches long, 3 feet 10 inches wide and 5 feet 3 inches high.

The wing is of the cantilever type, and is chiefly remarkable on account of the way in which it is tapered. Apparently there is a slight negative dihedral to the leading edge, the "wash-out" to the tips being obtained in this manner, and not, as is more usual, by raising the trailing edge progressively from root to tip. In this respect the wing is somewhat reminiscent of the "Alula," but otherwise it appears to be entirely different. The thickness of the wing is a maximum of about 2 feet at the root, and the space thus provided is made use of as a luggage compartment. The petrol tanks are mounted, one on each side of the fuselage, inside the



AN ALBATROS COMMERCIAL MACHINE: Plan, side and front elevations to scale

and the top covering of the fuselage is swept up higher. As a matter of fact, the Albatros "L. 57" has its driver's seat placed not unlike that of the new "K" type buses, i.e., partly over the engine. The seats in this cockpit are tilted back, and the occupants sit with their legs quite horizontal. This position, which at first sight might appear to be very uncomfortable, is, as a matter of fact, quite the reverse, as anyone can easily demonstrate for himself by sitting American fashion, with his legs resting on a table top. Being thus raised to a level with the top of the propeller tip circle the pilot certainly obtains a very good view forward, and as he is on a level with the leading edge of the wing his view to the rear and upwards and downwards is also fairly good. So far, the arrangement would appear to be a considerable advance over that of the Fokker, where the wing projects forward over the pilot's head, shutting off his view upwards, and, incidentally, causing a nasty swirling draught behind his head. In the Albatros "L. 57" the fairing behind the front cockpit is tapered off and is carried up over the nose of the wing.

The cabin, as already mentioned, is designed to accommodate six passengers, of which the two front ones sit facing

wing, from where, presumably, it is possible to feed the petrol direct to the carburettor by gravity.

In the form shown in the accompanying general arrangement drawings the power plant is a 160 h.p. Mercedes. Other engines such as the B.M.W. or Benz can, however, be fitted if desired, and the following table shows the main weights, performance, etc., with the three different engines:—

		160 Merc.	185 BMW.	200 Benz.
Weight, empty	.. lbs.	2,280	2,320	2,515
Useful load	1,920	1,890	1,910
Total weight	4,200	4,210	4,425
Duration hours	4	4	3
Weight of petrol and oil lbs.	383	350	370
Speed, ground level	m.p.h.	92	95	98
.. at 3,300 feet	..	91	94	99
.. at 6,600 feet	..	89	93	96
Ceiling ft.	11,400	13,000	14,800
Climb to 3,300 ft.	mins.	10.3	8.3	7
Climb to 6,600 ft.	..	26.5	20.3	16.3
Climb to 9,900 ft.	..	67.6	41.0	36.1

Japanese Air Mails

ACCORDING to reports received by Handley Page, Ltd., from Tokio, the Japanese Government has completed all arrangements for the early inauguration of a comprehensive air mail service throughout Japan. Aeroplanes capable of carrying four passengers in addition to mails and up to

6 cwt. of freight are said to be recommended for adoption by Mr. Oyamada, of the Japanese Transport Department, who was commissioned to study European methods of commercial aviation.

Tokio and Osaka are expected to be the first cities to be put into regular communication by air.

THE STOUT "BAT-WING" MONOPLANE

TEST flights were recently carried out at Detroit with a commercial model Stout "Bat-Wing" monoplane, and although this machine is designed on more or less unconventional lines, embodying new principles, it took off, with but a preliminary 50-ft. run, at once for a 20-minute cross-country flight on its first trial. It was piloted by the well-known American mail pilot, Bert Acosta, who claimed for this machine, after the trial flight, that it was a decided advance over anything he had ever before piloted. After the first lap around the field he found the 'bus was sufficiently stable to enable him to fly for minutes at a time with his hands and feet completely off the controls.

This machine is the design of William B. Stout, and was

way. Immediately behind is the cabin, accommodating pilot and two passengers. The pilot is located in front, and the passengers behind. Large windows are provided in the sides of the cabin, whilst a large window of non-breakable glass, immediately above the pilot, gives the latter a clear view of the air above.

The petrol tanks are located within the wings, well away from the engine, and the air intake for the carburettor is carried completely outside the body, thus reducing the risk of fire to a minimum. The radiator is fitted with shutters for high altitude work and operated from the pilot's seat. To minimise shocks, the landing gear has been fitted with oversized wheels and tyres. The cabin itself is luxuriously



The Stout "Bat-Wing" Limousine Monoplane: An American machine of somewhat unusual design. The cantilever wings, which are of veneer construction throughout, have an exceptionally large chord at the roots

built by the Stout Engineering Laboratories at Detroit, where experimental work on machines of this type has been carried on since the end of the War. It is a cantilever monoplane with thick tapering wings, mounted above the limousine body. The principal characteristic of the "Bat-Wing" is that the chord of the wing increases considerably from tip to root—in fact, at the root the chord of the wing is very nearly equal to the length of the machine itself. Veneer, or ply-wood, construction is employed throughout the machine, including the wings, which are internally trussed and completely covered with veneer.

The engine, one of the new 200 h.p. Packard, is mounted in the nose of the fuselage, driving a tractor screw, in the usual

furnished, having been laid out with the idea of maximum comfort for the pilot and passengers. With the engine running at high speed there is no more noise in the cabin than in an enclosed motor-car, and conversation may be carried on with ease. To the rear of the cabin is a special baggage compartment. All wing fittings and control rods are especially treated and absolutely rustproof.

The Stout "Bat-Wing" Limousine weighs 1,820 lbs., and its maximum speed is said to be well over 125 m.p.h., whilst the landing speed is but 45 m.p.h. We understand that the U.S. Navy has placed an order for six torpedo 'planes of the "Bat-Wing" type of all-metal construction with this firm.



Civil Aviation in Australia

"THE Federal Government's appointment of a Director of Civil Aviation has attracted renewed interest in aviation in Australia," reports the *Daily Telegraph* correspondent in Sydney. "By the arrival at Perth of Degaris on a flight from Melbourne in the DH 9 machine the pilot (Lieut. Briggs) indicated Transcontinental possibilities. The flying time was 18 hr. 12 mins., and the distance 2,169 miles. The route taken was via Mildura, the Murray River Valley, Adelaide, over the Transcontinental Railway. The first machine to cross the great Nullarbor Plain left Melbourne on the morning of November 30, and arrived at Perth on December 2 at midday. Degaris, who is a Victorian business man, desired to demonstrate the commercial utility of aviation. Aeroplanes are now frequently used in New South Wales for communication between the country and the town. A machine flew on December 2 in fast time from Sydney to Bathurst, across the Blue Mountains. The new Federal Department should stimulate the movement for connecting remote parts of the continent by air."

German Aviation Progress

ACCORDING to the Handley Page Berlin correspondent, the German postal authorities have contracted with the Bayerische Rumpflerwerke A.G. for a regular daily air mail service between Augsburg, Munich, and Frankfurt on the Main. The capital of the Company has also been increased from 1,000,000 marks to 2,500,000 marks.

A regular daily air service has also been decided upon

between Königsberg, Munich and Riga for the carriage of passengers and freight. Trial trips have already been made, the whole distance being covered by aeroplane in 5 hrs., as compared with three days by the present rail service. The regular air mails will begin next spring.

Extension of German Air Mails

THE Handley Page Berlin correspondent reports that the daily air mail between Berlin and Gelsenkirchen is now linked up with the important manufacturing districts within a 20-mile radius of Essen by means of a regular service of motor-cycles to which the local mails and parcels are transferred from the aeroplane by the postal authorities on arrival at the terminal aerodrome. The air mail leaves Berlin at 10 a.m. daily, and Essen is reached in 2½ hrs. as compared with 10 hrs. by rail.

The German Air Ministry are endeavouring to make arrangements for the establishment of an airport at Cologne with a view to linking up at that city with direct air services to Paris and London.

A Zurich-Munich Service

THE request of the Ad Astra concern to the Swiss Federal Air Department for a concession for an aerial service between Zurich and Munich has aroused some controversy locally. One party urges the Government to be more prudent before subsidising such a service, while the other side wants to see a network of aerial routes organised and running from a Swiss centre.

THE ROYAL AIR FORCE MEMORIAL FUND

A MEETING of the executive Committee was held at 7, Idlesleigh House, Caxton Street, S.W.1, on Thursday, November 25, 1920, at 3 p.m., Lord Hugh Cecil in the chair. Among the members of the Committee present were:—Dame Helen Gwynne-Vaughan, Air Vice-Marshal Sir John Salmond, K.C.B., Air Commodore Longcroft and Brooke-Popham, Messrs. F. E. Rosher, H. E. Perrin and W. S. Field.

A list of donations and subscriptions received since last meeting, on November 5, was submitted.

The Secretary reported that he had duly taken over from an Officer of the Air Ministry the two houses at Ascot, namely "Heath End" and "Woodcote," being the generous gift made to the Air Council by Mrs. Salting (and by the Air Council handed over to the Fund) with a view to the sale of the properties, the resulting sum to be utilised in founding scholarships for officers' sons, at approved schools. It is hoped to effect this sale (which is in the hands of Messrs. Hampton and Sons) about Easter next year.

The R.A.F. Memorial again came under discussion, and letters were read from the Dean of Westminster and Canon Carnegie, of St. Margaret's Church, as to the proposed site near Westminster Abbey, but nothing definite could be yet arranged. Meantime, the Chairman was requested to write to the Office of Works, asking them if they could suggest, and offer, any suitable sites in London, and the Chairman was further requested to write to the Admiralty and War Office to ascertain whether the Navy and Army had any purpose of erecting a Memorial to the Sailors and Soldiers who fell in the War.

With regard to the opening of a campaign in the provinces,

for raising funds, the Secretary was directed to proceed to Manchester early in December, to make preparations there for a public meeting, which it is hoped to arrange for about the third week in January.

The complete scheme of co-operation with other societies dealing with relief of distress to members of the Navy and Army, has been inaugurated, and comes into force at once.

The Secretary received instructions from the Committee to issue the first Annual Report of the Fund, the same to be made up to December 31 next, and to give a complete record of the activities of the Fund during the past year, and of course showing the exact financial position. It is hoped to issue this report about the end of January, if circumstances permit.

The question of starting Squadron Aid Societies, to be closely affiliated to the Fund, was discussed, but was left over for final decision at the next meeting.

At the conclusion of the business of the Committee, Brig.-Gen. R. H. More, Secretary of the United Services Fund, who had been invited to attend the Committee, made a statement setting forth with much clearness the aims and objects of Lord Byng's Fund, and affording the Committee much useful information.

The next meeting of the Committee was fixed for Thursday, December 16, next.

Amount of donations and subscriptions	£	s.	d.
announced up to November 4	102,000	9	4
Amount since received, up to November 24	388	7	10
Total	102,388	17	2

ROYAL AERONAUTICAL SOCIETY NOTICES



Lectures.—Lieut.-Col. H. T. Tizard, A.F.C., Fellow, will take the chair at the next meeting which will take place at 5.30 p.m. on Thursday afternoon, December 16, at the Royal Society of Arts, John Street, Adelphi. Abstracts of two papers will be read: "Possible Developments in Aircraft Engines," by Mr. H. Ricardo, A.M.Inst.C.E., M.I.Aut.E., and "The Installation of Aeroplane Engines," by Mr. A. J. Rowledge, A.M.I.Mech.E., M.I.Aut.E.

Owing to the advent of Christmas there will be no other meeting until January 20, 1921, when the Right Hon. the Lord Montagu of Beaulieu, K.C.I.E., C.S.I., A.M.Inst. C.E.,

A.M.I.Mech.E., will read a paper on "The Cost of Air Ton-Miles compared with other Forms of Transport."

Donations.—The Council desire gratefully to acknowledge the gift of "Fifty Years of Travel by Land, Water and Air," by Frank Hedges Butler, F.R.G.S., from the Author; "Aircraft, Its Development in War and Peace and its Commercial Future," by Evan John David, from Mr. E. Charles Vivian, both of which have been placed in the Library; and also a large number of back numbers of the *Aeronautical Journal* from Sir Charles Bright, F.R.S.E., M.Inst.C.E., which are out of print and in much demand.

W. LOCKWOOD MARSH,
Secretary

AIR MINISTRY NOTICES

Notice to Airmen. Denmark: Flying over Danish Waters

(1) Notice to Airmen No. 51 of May 10, 1920, is amended as follows:—

(b) *Lightships.*—Laeso Trindel lightship has been moved

(132) Aerodrome List Amendments (374357/20)

NOTICE to Airmen No. 106 (Consolidated List of Aerodromes), of October 1, 1920, is amended as follows:—

LIST C (b).—*Civil Aerodromes licensed as "Suitable for Avro 504 K and similar types of aircraft only."*

The following should be added:—

Aerodromes.				Nearest Railway Station.	Nearest Town.		
Name.	Lat.	Long.	Height above sea-level.		Name.	Distance from Aerodrome in miles (by road).	True Bearing from Aerodrome.
Caversham, Blagraves Farm..	51° 28' 30" N.	1° 0' 0" W.	260 ft.	Reading (G.W.R.) 2 miles	Reading	2	S.E.
The following should be deleted:—							
Exeter, Marsh Barton	50° 42' 30" N.	3° 32' 0" W.	20 ft.	Exeter (L. & S.W.R. and G.W.R.) 1½ miles	Exeter ..	1	N.
Pinhoe, Exeter ..	50° 44' 30" N.	3° 28' 30" W.	300 ft.	Pinhoe (L. & S.W.R.) ½ mile	Exeter ..	3½	W.S.W.
Sheringham ..	52° 56' 0" N.	1° 13' 0" E.	80 ft.	Exeter (L. & S.W.R. and G.W.R.) 3½ miles	Sheringham	½	N.N.W.
				Sheringham (M.R. and G.N.R.) ½ mile			

AIRSHIP PILOTING*

By Major G. H. SCOTT, C.B.E., A.F.C. (late R.A.F.), A.M.I.MEC.E.

Introduction

I FEEL it a great honour to have the privilege of addressing the members of the Royal Aeronautical Society on the subject of Airship Piloting, especially in view of the interest you have taken in furthering and generally assisting in the development of all types of aircraft.

Although the airship has hitherto not occupied the thought and brains of Aeronautical Engineers to the same extent as the aeroplane and seaplane, I feel sure the confidence and support of the Society will lead to a more general and scientific interest being taken in lighter-than-air craft, which is bound to result in more rapid progress in the near future.

I hope the discussion to follow will provide the foundation for solving some of the problems that will have to be faced, when piloting the airships over routes to various parts of the world, where totally different atmospheric conditions are likely to be encountered. Once these problems are solved, I feel that the future of the airship as a mode of fast long-distance transport is assured.

In the early days of sea-going ships, the captain of the ship worked the helm, and by his own personal observation and skill at the helm, navigated his ship in unknown seas, but his progress was slow and the distance covered comparatively small.

As the size of the ship increased, the captain handed over the helm to one of his men, and turned his attention to the navigation and the general working of his ship. As the ship grew bigger still, and the speed and range increased, he relegated more duties to his junior officers and turned his attention to the control and co-ordination of the whole.

It is the same with the airship. In the early days when airships were small, the pilot himself worked the controls, but as the size increased he turned his whole attention to the navigation and general piloting of his ship, his crew working the controls. Thus the captain of the large airship of the future, although having an intimate knowledge of the detail working of the airship, will merely control and direct, and his chief study will be the weather, and the best method of using it, to make a quick, safe passage.

It is this side of piloting that I will chiefly consider in this Paper, and will deal with it under four heads—

- (a) Aerostatics of Airships.
- (b) Aerodynamics of Airships.
- (c) Weather with regard to Airships.
- (d) Navigation.

Aerostatics

Before discussing the piloting of airships, it is necessary first to appreciate the static conditions which govern their performance.

(a) Lift of Hydrogen

In modern airships the gas used to give the buoyancy or lift is hydrogen. This gas has a weight of only 1/15 the weight of an equal volume of air at the same temperature and pressure.

That is, at normal temperature and normal atmospheric pressure, 1,000 cubic feet of hydrogen weighs approximately 5 lbs., whereas 1,000 cubic feet of air weighs 75 lbs.

So that under usual conditions pure hydrogen has a buoyancy or lift in air of between 70 lbs. and 72 lbs. per 1,000 cubic feet.

In practice it is impossible to obtain or maintain pure hydrogen in the airship, it is therefore necessary to know the degree of purity.

This is determined by means of a purity meter, which gives the relative density between the air and the hydrogen under test.

The relation between air and pure hydrogen is known, so that a relation can be calculated between the hydrogen tested and pure hydrogen. For convenience, it is assumed that the impurity is air, and the "purity" is expressed as the percentage by volume of hydrogen in a mixture of hydrogen and air, which would give a similar density to that of the mixture of gases tested. Thus a purity of 90 per cent. means a density corresponding to a mixture of 90 per cent. pure hydrogen and 10 per cent. pure air at the same pressure and temperature.

This figure has to be applied in calculations of the lift of hydrogen, and the true lift is obtained by multiplying the lift of pure hydrogen by its per cent. purity.

(b) Effect of Barometer on the Lift of Hydrogen

As an airship has a fixed maximum volume, it is usual to deal with the lift of hydrogen for a fixed volume; 1,000 cubic feet is usually taken as the unit of volume.

* Paper read before the Royal Aeronautical Society.

With alterations of barometer, the density of the hydrogen and the density of the air displaced, and therefore the lift of the hydrogen, varies.

For the purposes of calculation, Boyle's Law is sufficiently accurate.

Thus $PV = K$, or the density is proportional to the pressure, that is, the lift of a fixed volume of hydrogen is directly proportional to the pressure of the barometer.

It is assumed that the same pressure exists inside and outside a gas bag. No correction has, therefore, to be made in the case of temperature.

(c) The Effect of Temperature on Lift of Hydrogen

The density of air and hydrogen vary with temperature, and assuming a constant pressure the density varies according to Charles' Law, or the density varies inversely as the absolute temperature, therefore the lift of hydrogen varies inversely as the absolute temperature.

Taking temperature, purity and barometric pressure, the lift of hydrogen is given by

$$L = \frac{B}{T} \times P \times K$$

where L = Lift per unit volume of the gas.

B = Barometric pressure.

T = Absolute temperature.

P = Percentage purity of the gas.

K = Constant, depending upon the units used.

Superheating

In the foregoing consideration of the lift of hydrogen it is assumed that the hydrogen and air are under the same pressure and temperature. In practice this is reasonably correct with regard to pressure, but with regard to temperature very big differences can be experienced.

Thus when an airship is flying through a warm sun, the temperature of the gas is raised above that of the surrounding air. This condition is termed superheating, and in British practice is measured by the number of degrees Fahrenheit between the temperature of the air and the temperature of the gas. Thus a 10° superheat means the gas is heated 10° F. above the surrounding air.

The Effect of Superheating

If an airship contains a known quantity of hydrogen, that is, a known weight of hydrogen, and the temperature and pressure of the hydrogen are the same as that of the air displaced, then the lift of this fixed weight of hydrogen will remain constant whatever the pressure and temperature.

Thus in a rigid airship where the gas bags are not full, the ship can rise or fall, and as long as no gas is lost and no superheating takes place the lift will remain constant.

In practice a rigid airship is seldom full of hydrogen, and I will deal with the effect of superheating on an airship under this condition.

The volume of the gas in the airship depends upon the barometer and the temperature of the gas, and is given by

$$V = \frac{T_1}{B} \times K$$

where T_1 is the gas temperature.

Now this is the volume of air displaced, so that the lift of this gas is given by

$$L = \frac{B}{T_2} \times K \times V$$

where T_2 = air temperature,

$$\text{or } L = \frac{T_1}{T_2} \times K.$$

Thus the lift of the gas is increased on superheating and is calculated by taking the lift without superheating and multiplying by

$$\frac{\text{the absolute temperature of the gas}}{\text{the absolute temperature of the air}}$$

Or the increase in lift due to superheating = lift without superheating multiplied by
the degree of superheating (i.e., difference between gas and air)
absolute air temperature of air.

This quantity is known as the false lift.

There is an error in the above method owing to the fact that the weight of 1,000 cubic feet of hydrogen varies with the temperature, and it is therefore not correct to assume that the lift is directly proportional to weight of air displaced. In the above the temperature of the gas is only taken into consideration to obtain the new volume of the gas.

This error is, however, comparatively small, and is therefore neglected in practice in order to simplify the calculation.

A condition occasionally arises when the gas temperature is lower than the air temperature; the decrease of lift in this case is known as latent lift.

Aerodynamics

The study of the aerodynamics of airships is primarily a design problem, but it is so inseparably connected with piloting that I cannot neglect the subject in this Paper, especially in connection with future and larger ships.

Head Resistance.—The head resistance of airships of the same form for the same velocity varies as the (capacity)^{2/3} and the lift varies as the capacity.

The per cent. total weight of the airship required for propelling machinery to give a constant speed therefore decreases as the size increases, or, with a constant per cent. of machinery weight, the speed of an airship increases as the (capacity)^{1/3} or as the $\sqrt[3]{\text{length}}$.

At this increased speed the range for the same per cent. weight of petrol carried is also increased, so that for ships of the same form of the same per cent. weight of machinery and the same per cent. weight of petrol carried the speed and range each vary as the (capacity)^{1/3}.

Dynamic Lift.—The dynamic lift of an airship may be defined as the component at right angles to the flight path of the resistance of a ship moving through the air with its centre line inclined to the path of flight.

It is the vertical component of this dynamic lift that is employed to maintain an airship at constant altitude, or to drive her up or down, when the ship is not in static equilibrium, that is, when the lift of the gas is greater or less than the weight of the ship and her cargo.

With ships of similar form this dynamic lift may be taken as proportional to the resistance for the same angle of flight, or to borrow a term from H/A , the same "attitude" of flight.

Thus if the same per cent. weight of machinery is employed the maximum dynamic lift (expressed as a percentage of the displacement) varies as (capacity)^{2/3} so that practically the same degree of superheating can be dealt with.

But if a constant speed were maintained and the capacity increased, the per cent. weight of machinery would be decreased and therefore the degree of superheating that could be dealt with without loss of gas would decrease.

In the design of large ships this fact must not be overlooked, or for large ships with a long range it may be necessary to carry so much water ballast that the advantage gained by increase in size may be nullified.

Controllability

As there are so many factors that affect the controllability of an airship, I fear I cannot deal summarily with the subject.

A stream-lined airship, if travelling through the air at a small angle to the axis of the ship, instead of tending to return to the direction with its centre line parallel to line of motion, tends to increase this angle.

This has a marked effect on the controllability when a ship is flown "light" or "heavy."

Thus when a ship becomes light she appears to be nose heavy, and conversely when she becomes heavy she appears to be nose light.

This effect acts in favour of the pilot at certain speeds, but at high speeds, when a ship is more than a certain per cent. light or heavy, the effect becomes so great that the elevators cannot cope with it, and the ship, if heavy, will continue to climb, or, if light, continue to dive.

The correction if such a case should occur is to slow down the engines.

In the event of the elevators jamming, this unstable property of a stream-lined ship can be employed to pilot a ship back to her base.

The German airship pilots have experienced this effect, and in L.67 the horizontal fins are placed on the hull at a permanent angle down by the tail. This allows the ship to fly very heavy, thus permitting the pilot to take his ship to a great height when raiding, allowing for the release of weight in bombs and petrol used to bring his ship to equilibrium before landing.

Weather

There is a general idea that an airship is a fine-weather craft. This is only partially correct.

An airship up to the present time has been under the disadvantage of having to leave and enter its shed at the beginning and end of each flight, and as there is difficulty in handling a ship in and out of her shed in strong winds, this has limited

the application of the airship in the past to fine or moderate weather.

An airship once in the air is not a fine-weather craft, and a large ship with a good range and speed need not fear any type of weather.

Experiments are at present in hand which will allow of an airship landing or leaving a mooring mast or tower in strong winds, and when these experiments are completed there is little doubt that an airship will be almost as independent of the weather as sea-going passenger liners.

I will divide up weather into groups, and discuss each separately.

(a) Wind

Strong winds in this country and in the Atlantic are caused by depressions or cyclones. These cyclones are approximately circular in form with the wind blowing round them in a counter clockwise direction with a slight bearing towards the centre or low pressure zone.

They vary very considerably in size, and may cover half the Atlantic or be only 200 miles in diameter. The larger the depression the longer warning we have of its approach, and therefore the easier it is to avoid or utilise.

Also, except in rare cases, a very large depression is only associated with very high winds, over a comparatively small area.

The strength of the wind is largely dependent upon the distance apart of the isobars. The shorter this distance the stronger the wind. It is obvious, therefore, that where the winds are strong and the isobars close together the area covered must be small.

Thus a pilot, on meeting a strong wind, turns broadside on to the wind, and in a very short time he will be through the bad zone and in a light or favourable wind. It will be seen that the time taken for the ship to cross the bad weather zone does not depend upon the strength of the wind but upon the speed of the ship, also that the amount the ship drifts out of its course depends, on the other hand, on the time taken and the speed of the wind. It is therefore necessary that the ship should have a good turn of speed, so as not to be driven too far out of her course.

Except in very rare circumstances, such as when the base at which the pilot wishes to land is in the bad weather zone, a pilot should never beat directly into a strong wind, and even in the above case it often pays to lie off for a few hours, as the movement of the centre of the depression will move the area of strong wind away from the base.

It is owing to this movement of the centre of a depression that, except in exceptional circumstances, a very strong wind does not blow for very long in one place. I have pointed out above the general method of dealing with strong winds, and endeavoured to explain that they are not a serious obstacle to the airship and should not interfere much with schedule flights.

A much more difficult wind for the airship pilot to deal with is a head or beam wind of from 20 to 30 miles per hour, as this may blow over a comparatively large area and for long periods.

In order to deal with this wind, good meteorological reports must be at the pilot's disposal, and he must vary his course sometimes 12 to 24 hours ahead in order to circumvent such a wind. As an example, the pilot is flying from Malta to Norfolk, there is a large depression centred N.W. of Scotland, giving a westerly and south-westerly wind over the South of England and North of France. If the pilot endeavoured to make good a direct course from Malta to England he would be obliged to edge up into a 30-mile broadside wind over several hundred miles, and the time taken for the journey would be greatly increased.

If, however, the pilot was supplied with good meteorological information he would set his course so as to pass out into the Bay of Biscay, just north of the Pyrenees, and when he encountered westerly winds of increasing force he would turn north at right angles to the wind and use the drift to make his base. Thus during no part of his journey would he be heading into a wind, and although the course taken is somewhat longer than the direct route, the time taken will be very little in excess of the still air time, and with a reasonable amount of spare engine power the airship could still make its scheduled time on the journey.

Necessity of knowing true height above surface.—In order to use the meteorological information to the best advantage, the pilot should be in a position to read the ground barometric pressure at any moment, so as to know whether he is approaching the high pressure or low pressure zones, or flying parallel to the isobars, and thus estimate the rate of movement of the depression.

This is impossible at present, as there is no known method by which a pilot can measure with accuracy or regularity his true height above the surface. Thus the barometric pressure

measured in the ship gives no accurate measurement of the surface barometer.

Some instrument or method of overcoming this difficulty is most urgently needed.

Effect of height on wind velocities.—At the present time there is not a great deal of data regarding the variation of wind velocities and direction with height. Such data as is available chiefly deals with anti-cyclonic conditions when the air is clear and a pilot balloon can be sent to a great height. This is the fine-weather condition, when the need for alteration of altitude to avoid bad winds is rarely necessary.

The cyclonic conditions over the British Isles are nearly always associated with comparatively low heavy clouds when it is impossible to follow a pilot balloon to any height, and it is under these conditions that further data is required.

My general experience has been that westerly winds increase with height, whereas easterly winds tend to decrease, both tending to turn anti-clockwise.

We, however, had an interesting experience on "R.34" on the trans-Atlantic flight which would tend to qualify the above statement.

When within 800 miles of Newfoundland, "R.34" encountered a shallow depression of about 600 miles diameter and giving a ground wind of about 45 to 50 miles per hour, with low clouds and driving rain. After several hours, during which time we were being driven north, it was decided to climb through the clouds and try to check our position by a sun sight with a cloud horizon. At 5,000 feet we passed clean out of the top of the depression, and into a light westerly wind. This was calculated by cloud drift, and later checked by the time and position we passed over the Newfoundland coast. Thus in this case, by rising a few thousand feet, we avoided the strong southerly wind which was blowing at the surface.

I very much doubt if in the ordinary case over land the comparatively low height to which "R.34" ascended would have helped us very much, but it rather pointed to the fact that over a large expanse of water like the Atlantic many depressions do not rise to the high altitudes generally supposed.

In this case, as in many other cases, the heaviest clouds were situated where the wind change took place.

Permanent Winds.—The advent of the steam ships has to large extent reduced the value of the permanent winds of the world, but these winds played a great part in the early development of the Mercantile Marine, and are destined to play a great part in the development of aerial commerce.

It was due to the position of Spain, situated almost in the trade winds, that gave her such an advantage in the development of Central and South America, and it is interesting to note that all the Spanish possessions in America were situated so as to use the trade winds.

The permanent winds of the world may be divided into two classes: (1) The easterly or trade wind, which blows north and south of the equator in easterly direction and towards the equator; (2) The westerly drifts, which are found in the Arctic and temperate zones.

The principal westerly drifts are in the North Atlantic, where they are modified and interrupted by the cyclones which pass over this region, and the great westerly drift round the Antarctic Continent which affects the southern part of the South Atlantic, the Indian Ocean and the South Pacific Ocean.

There are also many smaller permanent winds and also seasonal winds, such as the Monsoons.

In considering the future airship routes of the world, these winds must be taken into account.

Examining the probable routes to Australia and South America, it will be seen that the tendency is for the westerly journey to be made near the equator, using the trade winds, whereas the easterly journeys are always farther from the equator so as to use the westerly drifts. The gain in speed and regularity is so great that even with greatly increased speed it is still advisable, where economic conditions allow, to choose a route that will employ these winds.

Height of Trade Winds.—Although the area of the trade winds is well known and well defined, very little is known except of the surface winds, and it is very important that further investigations should be carried out to find to what height these winds extend and if there is a return westerly wind at any reasonable height.

Over the West Indies the greatest force is found at between 2,000 and 3,000 feet, and a falling off in wind velocity occurs above this. It is probable that well clear of land the greatest velocity is even lower, and comparative calm or a return or trade reversal wind will be encountered at no great height. If this is found to be the case the commercial value of these trade winds will be enormously increased.

Convictional Winds.—These winds, compared with the

permanent winds, are very local; they are met with all over the world, and are due to the uneven heating of the earth's surface. Land and sea breezes are of this class, also the permanent northerly wind over Egypt. Convictional winds are met with in the Atlantic where the gulf stream and Labrador currents travel parallel to each other. They are of distinct use to the pilot who understands them and knows how to make use of them, but owing to their small area they are, of course, of small importance compared to the permanent winds.

(b) Temperature

I have already described superheating under aerostatics and aerodynamics, but having given no indication as to the degree that may be expected or best method of reducing this effect.

In most cases superheating is due to direct heat from the sun, and is therefore likely to be much more serious near the equator, but until flights are carried out in tropical or semi-tropical climates it is difficult to estimate the degree that we may expect.

The effect of the sun is to raise the temperature of the gas, and the maximum temperature obtained in still air depends upon the sun's intensity, without respect to the surrounding air. The degree of superheating, however, is the difference between this temperature and the temperature of the surrounding air, so that the higher the temperature of the surrounding air the lower the degree of superheating for any known sun's intensity.

The sun's intensity tends to increase with height whereas the air temperature generally decreases, so that the best method of reducing superheating is to fly low.

The greater the degree of superheating or difference of temperature between the gas and the air, the more efficient the cooling due to the ship's motion through the air, but the result will still be a greater degree of superheating with height.

The type of outer cover is also a big factor in superheating; the better the outer cover the greater the amount of sun's rays reflected, and therefore the less heat absorbed which has to be dissipated to the air by the motion of the ship, and therefore the lower the temperature of the gas.

Speed also plays a part, as the higher the speed the more easily is heat carried away by the air; so that the best method under most conditions to reduce excessive superheating is to go fast and fly low.

Inversion of Temperature

There are certain conditions when the temperature of the air on the ground is lower than the temperature at a height. This occurs at certain times of the day in many parts of the world, and when such a condition is encountered the pilot will only increase his superheating by flying low.

"R.34" encountered a very marked example of this over the ice fields off Newfoundland. The lower air was cooled to below freezing by the ice and the sun was very powerful owing to the clearness of the air above.

The maximum superheating on this occasion was as much as 40 deg. F. at 4,000 feet, which is the greatest I have yet encountered.

An inversion of temperature may cause trouble when leaving the ground if unexpected, as if a pilot ballasts up his ship just slightly light on the ground he will find it practically impossible to force his way up into the hot air above, and as this inversion is often found at only 200 to 300 feet, there is a serious danger of hitting some obstacle.

This condition is more generally encountered in the tropics.

Method of Superheating to Reduce Gas Consumption

Superheating is not always a drawback, as if a ship leaves the ground during the heat of the day when highly superheated, and lands again at night with no superheating, the loss of lift due to the false lift which disappears after sunset will partially or wholly counterbalance the weight of petrol consumed, so that little or no gas need be expended.

Electric Storms

Electric storms are the airships' greatest danger. There is not a very serious danger from lightning, as on at least two occasions German airships have been struck without causing serious damage.

The chief dangers from electric storms lie in the very serious bumps and eddies that accompany them; these can be extremely violent and very seriously stress the structure of the airship.

The electric storms are generally confined to certain areas and certain periods of the year; also it has been my experience that an electric or thunderstorm follows a very definite track, and there are many places both in England and abroad where a thunderstorm is unknown; it may pass within a few miles but never over that particular spot.

It should therefore be possible to chart the disturbed areas

and tracks of storms, showing the areas immune from storms. If such a chart was available, and reasonable warnings are given, it would be extremely bad pilotage for a captain of an airship to allow his ship to be overtaken by a thunderstorm.

My experience has also been that thunderstorms do not travel out to sea; they may follow a line of islands, or cross from one mass of land to another, but they always tend to hug the coast; I have also never met a thunderstorm at sea. I am, of course, speaking entirely of the temperate zone as I have no experience of the tropical thunderstorm.

It is of particular importance that data on this subject should be collected.

Instrument for detecting direction of a thunderstorm.—This instrument would be of very great value to an airship pilot, as for many years to come he will of necessity be flying over regions only partially charted, and the fact of knowing from which direction the atmospherics are coming will enable him to avoid disturbances.

Electric Disturbances at Great Height

There is very little doubt that very violent thunder or electric storms take place at high altitudes, of which there is no indication on the ground.

"R33" recently encountered such a storm, and neither the wireless nor meteorological instruments at Howden gave any indication of the disturbance; reduction in height would be a method of avoiding such a disturbance.

In the same way under certain conditions when violent atmospherics are encountered at low altitudes, higher altitudes may be free from disturbance.

Clouds and Fog

Neither clouds nor fog seriously inconvenience an airship. With present navigational facilities a good course can be maintained without seeing the ground, and the stability of the airship prevents any inconvenience in flying.

The effect of heavy rain is to make an airship become heavy, but this can generally be avoided by alteration of height.

In a cloud that does not reach to the surface of the earth the driest part is the bottom, so that if a ship is becoming heavy flying through clouds, the correct method is to reduce height, provided it is inconvenient to fly above them.

When flying over clouds it will generally be found that on the uneven surface the highest points have a tendency to lean over in one direction.

This gives an indication of the relative velocity and direction of the wind above and below the cloud bank. If the top surface is smooth and flat very little difference in wind need be expected.

The use of clouds for weather forecasting is a very big subject, and outside the subject dealt with in this Paper. It is, however, a most important study for the airship pilot, and should be given a more important position than it holds at present.

The observer on the ground is often handicapped by the presence of low clouds which have slight significance for weather forecasting, and is unable to get a good view of the higher and important cloud formation. The observer in the air has not this handicap as he can fly above the low cloud and get an uninterrupted view.

Snow

The chief danger from snow is that it may, under certain conditions, cake on the bow of the ship and drive it down owing to its weight.

It is, however, only the soft wet snow that tends to cake, and by rising 1,000 feet or more dry snow will be encountered which will not tend to collect on the ship. There is an electric effect felt from flying through dry snow, and the ship is apt to become highly charged, so that it is always advisable to pull up the aerial under these conditions.

Navigation.

(a) Dead Reckoning

This method can only be used when the surface of the earth is in sight, and although in many parts of the world this may be a common condition, over the North Atlantic and the British Isles it is the exception and other methods must be employed.

Over land.—When flying over a well-surveyed civilised country it is merely a question of map reading. If, however, the country is only partially surveyed, the same methods will have to be employed as when flying over the sea.

Over the sea.—The chief instrument used is the Drift Indicator. In this instrument hair lines on glass or thin wires are arranged in a horizontal plane parallel to the earth's surface, and while observing through an eyepiece, it is possible for the pilot to move the glass or wire round until the objects on the earth's surface appear to travel along the lines in the instrument; the angle is then read off between the line of

flight of the ship and the line made by the wires. This angle is known as the drift angle, and is given in degrees port or starboard. The direction of flight of the ship is known so the direction the ship is making good over the ground can be calculated.

On some of these instruments it is possible to measure the speed made good over the ground by timing the passage of an object between horizontal lines at right angles to the drift lines, but in order to obtain a correct estimate of ground speed it is necessary to know the true height above the ground. The barometer in the ship does not necessarily give this owing to a possible alteration of barometric pressure at sea level or variation in height of land that the ship is flying over, so that this is an additional reason for the design of some instrument to give this true height of the ship above the earth's surface.

In the case where the sun is nearly overhead and the angle of drift is small, another method of obtaining ground speed is to time the shadow past any fixed object.

A true height above sea level can also be obtained by measuring the angle subtended by the length of the shadow with a sextant, the length of the shadow being known.

There is another method that can be employed where the height of the ship above the ground is not a factor.

A drift angle is taken, first with the ship flying on her true course and then with her flying at approximately 45 degrees either side of this course.

With the construction shown the true wind direction and strength is found and the speed made good over the ground can be calculated.

This method necessitates taking the ship off her course, but if she is flown about the same time on both legs of the triangle little time is wasted, and any error in the ship's position can be calculated and allowed for after the wind direction and strength has been determined.

(b) Sun and Star Sights.

The only difference between using this method on surface craft and airships is the very large difference in the height of eye, and therefore distance of the horizon; this often makes it difficult to obtain a good sea horizon, so that a cloud horizon or mist horizon has often to be used. These horizons are on the whole satisfactory, but owing to the irregularity of the cloud formation great accuracy cannot be expected, but an average degree of accuracy of about 10 to 15 miles can be obtained, which for most cases is sufficient.

The height of eye above the cloud or mist is obtained by descending to the top of the mist or cloud surface and then rising a definite distance above it. It is advisable to rise a considerable distance above the cloud or mist surface as this reduces the error due to irregularities.

The types of instrument employed are:—

1. Naval Pattern 7-in. Sextant.

This type of sextant is most suitable for taking observations to a natural or cloud horizon. It is necessary, however, that the means of several sights should be obtained, having rejected those which are obviously in error. The disadvantage of this type of sextant, however, is its weight and head resistance owing to its size. For this reason a naval pattern 4-in. sextant has considerable advantages for similar observations.

Observations to sea horizon with either of these sextants give fairly good results, but are entirely dependent upon the clearness of the sea horizon and a correct estimation of height for dip allowance. Double altitude observations of the reflection of the object on still water have given very good results, but it is obvious that instances of this kind are not common and that observations to reflection on the surface of the sea, even under best conditions, would not be reliable.

During a 1,100-mile flight round England carried out recently, the performance of various navigation instruments was investigated. The errors in position lines obtained from observations with the 4-in. N.P. sextant by observing the reflected image in a pool was 5 miles and 6½ miles, the result being worked on a single observation in each case.

On other occasions, however, when there was less time to make the observation owing to the smallness of the pool, the errors were considerably greater. It is clear, therefore, that this is not a method which can be of general use.

2. The R.A.E. Bubble Sextant.

This type of instrument is a complete departure from the pattern of the Naval Sextant, and is especially adapted for use in the air. Its main features are a bubble horizon with a combined index and object glass, which is set at different angles by the revolution of a spiral cam, to which is attached a scale graduated in degrees.

The bubble chamber contains alcohol and has a flexible wall which may be extended or compressed by means of a screw, so enlarging or diminishing the alcohol vapour bubble. The

bubble itself is formed under a concaved glass roof which may be illuminated at night by a lamp of variable luminosity. The image of the bubble is reflected by means of a prism on to the object glass, which simply consists of a plain sheet of glass which acts as a semi-reflector. The image of the celestial object is seen reflected on this same glass surface, and is brought into coincidence with the bubble by revolving the spiral cam, the angle of inclination of the glass being registered on the scale.

This type of sextant obviously does away with the necessity of a natural horizon, whether land, sea or cloud. In common with all artificial horizons when used in aircraft, however, the level is subject to error due to the acceleration of the machine acting on the bubble.

Semi-diameter calculations are also eliminated by the use of this sextant.

One difficulty with this instrument is to obtain an index error. This, however, can be obtained by suspending a mirror vertically and taking the reading of the image of the observer's eye in the mirror.

On the Cairo to Cape flight the errors in the position lines, from observations with this type of sextant, were from 4 to 12 miles.

During a recent extended flight the maximum error in position was as much as 34 miles obtained from the mean of six observations, and the minimum error was five miles from the mean of four observations. The variation was due to the difference in atmospheric conditions on different days, the bad results being obtained on extremely bumpy days.

These tests were carried out in an aeroplane, and better results may be expected in an airship owing to the slower movement.

Many other designs of sextants involving the use of bubble horizons and reflected back and front horizons have been used, but their low degree of accuracy and disadvantages in design have led to their elimination.

Instruments for the rapid solution of the spherical triangle by means of plotted curves and graphical representation of formulæ have been tried, amongst which may be mentioned the Baker Navigating Machine, the Veater Diagram and the

d'Ocagne Nonogram. These, however, have not given the high degree of accuracy desired under all circumstances, but were admirable as a stop gap.

The Bygrave Slide Rule has given remarkably good results and is rapid in solution. It consists of two cylindrical concentric scales—one a cosine scale and the other a tangent scale—and by dividing the spherical triangle into two right-angled triangles the zenith distance and azimuth can be computed.

Directional Wireless.

The use of directional wireless will no doubt play an important part in the navigation of airships in the future, and even at the present time forms a means of checking a D.R. position or a fix, but owing to the atmospheric errors that cannot be calculated or allowed for, and the difficulty of always obtaining a good fix, it should only be looked upon as an important aid and not a substitute for other forms of navigation. A good pilot should use every method available to check his position, however accurate any one of them may appear to be.

Conclusion.

I have endeavoured to put before you the difficulties encountered in airship piloting, and the methods employed to overcome these difficulties. I have tried to show you that an airship is not a fine weather craft, and that with adequate ground organisation there is no reason why it should not fly anywhere in the world under any conditions.

I have tried to indicate from the pilot's point of view the main point to be considered in the design of ships of increased size, namely, the increase of speed, both to enable good regular flights to be made under all weather conditions and to reduce the difficulties from superheating.

I have dealt entirely with the ship in the air, and leave it to someone else to discuss the ground organisation, one of the chief features of which is airship mooring.

This mooring is now an accomplished fact and only wants developing to make it of practical value, and I hope I have shown that, as soon as mooring of airships has been developed, the airship for long-distance regular schedule flights is a sound practical proposition.

A New Coupe Deutsch

At the banquet of the Aero Club of France on December 2, a letter was read from Mme. Henry Deutsch de la Meurthe to M. Michelin, President of the Club, offering, on behalf of the Deutsch family, a new Coupe Deutsch, for an International Speed Competition, together with a sum of 200,000 francs in prizes.

The Michelin Prize

It is not altogether surprising that so far no entries have been made for the prize of 500,000 francs offered by M. Michelin just before the last Paris Salon. It may be recalled that the entrant must fly at a speed of more than 200 kiloms. for the first hour, then during the next hour cover not more than 10 kiloms., and finally land in a maximum radius of 5 metres. The prize, however, will remain open until October 1, 1930, and only French aviators are eligible.

Air Mails for Morocco

THE Postmaster-General announces that the air-mail service between Toulouse and Casablanca (Morocco) is now being carried on three times a week in each direction. Packets should be posted in time for despatch from London on Saturdays, Mondays and Thursdays, in the mail for Paris, for which the latest time of posting at the G.P.O., London, is 3 p.m. for letters and postcards and 2.30 p.m. for printed papers, commercial papers, and samples.

The Airco Service to Paris

THE appointment of a receiver for the Aircraft Manufacturing Co., Ltd., appears to have been responsible for a report that the Airco London-Paris service was to be discontinued. We understand, however, from Mr. Frank Searle, managing director of Aircraft Transport and Travel, Ltd., that there is no intention at present of stopping the service.

A Record Trip to Paris

WITH the aid of the gale, one of the Airco 4 limousines, on the Handley Page services to Paris, made a record flight on December 4. Piloted by Lieut. Vaughan Fowler, and carrying two passengers, the machine left Cricklewood Aerodrome at 1.17 p.m., passed over the aerodrome at Lympne in 33 mins., and reached Paris in 1 hr. 48 mins.

The Liore-Olivier Amphibian

TESTS with the three-motored flying-boat exhibited by MM. Liore and Olivier at the last Paris Show not having

proved satisfactory, the makers set to work to transform it into an amphibian, as suggested by the Technical Section of the Aviation Department. A special chassis has been fitted and, piloted by the naval pilot Martin, the machine has made several flights at Villacoublay, the best including a climb to 2,500 metres in 32 minutes. Theoretically, the ceiling of the machine should be about 3,500 metres.

The land chassis is of the retractable type, which when the machine rises in the air can be drawn up under the lower wing.

A Caproni Liner

SOME details are to hand from Turin of a machine being built at the Caproni works which is really of the "giant" order. It is a hydro-triplane, fitted with eight 400 h.p. Liberty motors. The three planes are 40 metres span, and fitted with ailerons. The eight motors are arranged in tandem, four at the front and four at the rear of the planes, and mounted in nacelles which are joined by false fuselages. The machine is fitted with an automatic stability device, and is controlled by a wheel, the working parts being fitted with ball bearings, so as to reduce the strain on the pilot to the minimum. An electrical signalling system is installed for communicating with the engineers.

There is accommodation on board for ninety passengers.

Progress in Argentina

MUCH enthusiasm in the Argentine has been shown in aviation since the demonstration school at El Palomar was established by Handley Page, Ltd., in December last. Many pilots have been trained there for Government service, as well as private owners who have purchased aeroplanes for the establishment of local services. A popular feature of the school has been the periodical demonstrations which have taken place there, and also the many excursion flights.

To Our Readers

As we continually receive complaints from our readers that they experience difficulty in obtaining their copy of FLIGHT promptly each week, we would point out that under such circumstances the publishers will be glad to receive subscriptions. If the appropriate remittance is sent to the publishing offices, 36, Great Queen Street, W.C., it will ensure FLIGHT being received regularly each week upon the day of publication.

AIRISMS FROM THE FOUR WINDS.

THE association of Mr. Winston Churchill's name as a possible successor to Mr. Chamberlain at the Treasury conjures up a long array of possibilities. As Mr. Churchill is credited with having, even in these lean times, the call of quite three hats, will he essay the rôle of a Ministerial Trinity by adding the Chancellor of the Exchequer to his present dual control? With the present Government anything would appear to be possible, although if India turns out to be Mr. Churchill's new sphere, even *he*, with all his versatility, will have to be content with wearing one Trilby at a time.

THE new Deutsch de la Meurthe prize of 200,000 francs for aeroplane speed is another welcome sign of encouragement across the Channel, although it should be helpful to us this side, as the offer is an international one.

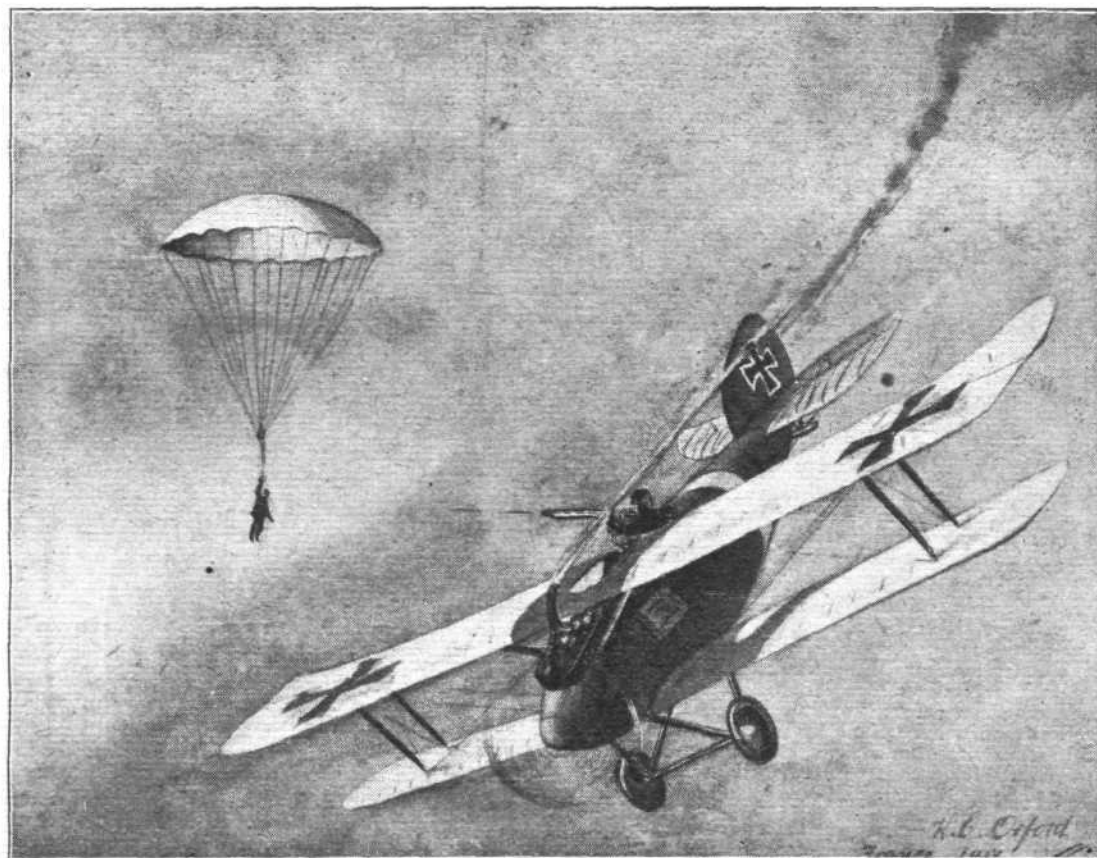
TAKEN literally a message from London published in Paris *L'Auto* last week would suggest that to win the new Deutsch prize *some* speed will have to be attained, as in this report it is complained that the Paris-London 'planes already beat Wireless. But, speaking seriously, there would appear to be some weak point in the system of wireless directions to aeroplanes, if the statement made is correct. It is alleged that it frequently happens that aeroplanes arrive at Croydon before the wireless message announcing their departure from Paris. This is practically always the case in respect of messages recording their passage at Sainte Ingelvert and Lymgne. It is put mildly that under these circumstances if wireless is to be really helpful to the cross-Channel service, "the speed of wireless messages on this route must be considerably accelerated." Why not put some tried and hereditary official of the L.C. and D. Railway on to the job of getting a move on matters wireless. Even he might be able to beat the present *impasse*.

NOT over many have had the privilege of Lord Desborough in being able to read their obituary notices *twice* in a lifetime and still "carry-on" merrily. The second "greatly exaggerated report" the other day in this connection was taken quite good humouredly by the victim, and afforded an opportunity for a sheaf of congratulatory messages from the vast circle of friends and admirers of the President of the Imperial Air Fleet Committee. Lady Desborough was the first to ring up her husband just to ask him if the announcement was true, being, like so many of his friends, quite satisfied there was nothing in it. The previous doing to death of the Earl was some years ago in connection with a mountaineering adventure on the Matterhorn. We venture to add our congratulations to the long list already recorded.

REALLY there'll have to be a new name for the Police "Flying Squadron," as the motor mounted section of Scotland Yard has been euphoniously dubbed by the popular Press. It gives too much latitude to the enthusiastic young journalist to indulge in "Air Sleuths" and what not. It is hardly cricket to lay such traps for the imaginative innocent of the precincts of Fleet Street. Moreover, since its first discovery down Hull way, it has cropped up in various directions with such irritating frequency that we would suggest—here's a 40 h.p. brain-wave—these young literary lions might for the future accept "motor squad," instead of ringing the changes on smart captures by the police "flying squad." Why the other day one of these fledglings slipped up badly on "You can no more do that than fly."

IN the picture at the foot of this page and the picture on the next page an incident of the War is well set out, how a Hun straffer came to grief from over-confidence. The drawings are by W. C. Orford, a young soldier who drew them at

An Incident in the War: Near Cambrai a Hun two-seater shot down one of our observation balloons, then turning his machine-gun on the helpless observer as he swung undefended from his parachute (No. 1). The following day the same stunter tried to repeat his performance, but this time he was not so lucky, as a British scout dropped down from above, and the Hun actually struck the ground before his victim, the balloon (see No. 2 on next page). These incidents are depicted in our pictures by Mr. Orford



the time of their occurrence. These and other drawings of Mr. Orford's which we reproduced some time ago were spon-

taneous first efforts of an amateur, it being another instance of developed art talent in the trenches.



An incident in the War: No. 2.

A Balloon School Association

WITH the object of forming an "old boys'" association, ex-officers and men who passed through the old Balloon Training Depot (R.F.C.) at Roehampton and No. 2 Balloon Training Depot, R.A.F., Richmond Park, are asked to forward their names and addresses to Mr. S. Buckenham, 148-9, Holborn, E.C. 1.

Christmas at the London Country Club

FOR those who wish to get away from London for a few days at Christmas time the programme of festivities arranged

by the London Country Club (formerly the London Flying Club) should prove attractive. There will be a *Thé Dansant* (with exhibition dancing), followed by a *Diner Dansant* and *Café Concert* in the evening, on Sunday, December 26, while on Boxing Day, December 27, a children's Christmas Tree party with motor-car rides, bran-tub, fish-pond, Punch and Judy show, etc., will be the chief item in the proceedings. A carnival and fancy dress ball is also being arranged for New Year's Eve, as well as other festivities for Sunday, January 2. The Manager, London Country Club, Hendon, N.W.9, will be pleased to supply full details.

AVIATION IN PARLIAMENT

R.A.F. Technical Depot

SIR W. JOYNSON-HICKS, in the House of Commons on November 30, asked the Secretary of State for Air whether the Sub-section of the Air Ministry, known as R.D. 4, has the responsibility of examining, considering and advising the acceptance or rejection of certain highly technical drawings and specifications submitted to the Air Ministry by manufacturers of aircraft; and how many people are employed in this Section, their names, date of appointment, and their technical and practical experience, and qualifications, if any?

Mr. Churchill: The Section referred to in the question is responsible for advice on the matters referred to, but decisions as to acceptance or rejection do not rest with it. The Section is staffed with officials of suitable technical qualifications and experience, and its services are supplemented by those of a special consultant. The qualifications of individual members of the staff cannot conveniently be discussed by means of question and answer in this House.

Allegations Against Officials

SIR W. JOYNSON-HICKS asked the Secretary of State for Air whether he is aware that on March 11, 1920, the Air Council came to the conclusion that there existed a *prima facie* case for appointing a Committee to enquire into the allegations of a certain aircraft firm to the effect that certain Government officials who by reason of their office received technical information from the company concerned had made improper use of that information in connection with patents subsequently taken out by them, and that they used their position to hinder the development of the company's work for other than reasons of public policy; and whether he will suggest to the Committee that their enquiry should be open to the public and the Press, and that such witnesses as the Committee may see fit to call should be allowed the assistance of counsel or solicitor if they so desire?

Mr. Churchill: The answer to the first part of the question is in the affirmative, and to the second in the negative. The object of the Air Ministry has been to ascertain in the simplest and most direct manner, not whether certain Government servants had acted illegally, because there was no question of this, but whether they had acted in such a way as to prejudice the interests of a private firm. For this purpose, a Committee was set by agreement, consisting of representatives of the Air Ministry and the commercial interests concerned under an independent chairman; and it was further agreed that their enquiry was to be without prejudice to the legal rights of any of the parties. Such a body was evidently never intended to exercise judicial functions, and I do not see my way to ask the Committee to change the character of the enquiry which has been entrusted to them.

The Controller of Patents, after a lengthy public hearing under the Patent Acts, has just decided that Mr. Mooney's patent was not infringed by the Government officer (Major Wylie), who took out a subsequent patent. It may be anticipated that the Committee at their next meeting will hold that this decision disposed of the first of the two terms of reference.

SIR W. JOYNSON-HICKS: Having regard to the fact that all these allegations are made against officers of the Air Force, would it not be better in the interests of the officers themselves, as well as those who make the complaint, that the matter should be discussed publicly?

Mr. Churchill: I do not quite see any sufficient reason to depart from the regular procedure we are adopting. If you were to have a public enquiry in every case where allegations are made against British officers, there would be hardly any means of getting through the business.

SIR W. JOYNSON-HICKS: Is my right hon. friend not aware that the allegations here were made by the Society of Aircraft Constructors, who alleged that there was a *prima facie* case?

Mr. Churchill: They have their legal rights, and if they choose to make allegations of that character which infringe the law, they will be themselves liable to have these allegations tested in the courts.

Airships for Civil Use

COMMANDER VISCOUNT CURZON asked the Secretary of State for Air whether the larger airships of this country are to be turned over to private concerns; whether, before any changes of policy with regard to the Air Force take place, he will undertake that Parliament will have an opportunity of debating the matter; what work has recently been carried out by our large rigid or semi-rigid airships; and whether all these airships are to be considered as being in full commission and in a state of complete readiness for use in all respects at short notice?

Mr. Churchill: The Department of Civil Aviation will temporarily take over, as from December 1, all airships, bases and material, surplus to service requirements, in order to carry out experimental work of an operational character, such as mooring-mast tests and flights of primary importance, to gauge the ships' capacity for commercial operation. This arrangement involves no modification of policy in regard to the Air Force. The work on which rigid airships have been engaged is that of training Royal Air Force and American personnel, and routine work with the Navy. With regard to the last part of the question, these airships cannot all be considered as being in full commission.

Viscount Curzon: Does the right hon. gentleman's answer mean that a proper force of airships to co-operate with the Navy will not be available in future, but will belong to the Department of Civil Aviation instead?

Mr. Churchill: No, Sir; we are keeping as many airships as we can possibly afford for work with the Navy, but we have more airships than we can afford to man and staff in the Air Force, and these are being used experimentally by the Civil Department, and we should be very glad if commercial firms would come forward and take them over.

Ex-German Airships

VISCOUNT CURZON asked the Secretary of State for Air how many flights have so far been carried out by the ex-German airships handed over to this country; whether any experiments have so far been carried out with them; and to what use is it intended to put them in the future?

Mr. Churchill: No flights have been carried out so far with ex-German airships. The experiments conducted with them have taken the form of investigating German methods of design and construction. These airships are surplus to Royal Air Force requirements, and will be dealt with in the same way as surplus British airships.

R.A.F. Expenditure

MR. LAWSON asked the Secretary of State for Air what has been the total expenditure on the Air Force, apart from demobilisation, in each theatre including Ireland and this country, since the Armistice?

Mr. Churchill: This information could be obtained only after a great amount of calculation and research out of all proportion to the value of the result, and in view of the depleted staff available for work of this nature, I would ask the hon. member not to press for an answer.

MR. GLANVILLE asked the Secretary of State for Air what is the present monthly rate of expenditure on the Air Force in Ireland?

Mr. Churchill: The estimated monthly rate of expenditure on the Royal Air Force in Ireland is £37,000. Of this amount £8,700 represents additional expenditure due to existing conditions in Ireland.

Cadet College, Cranwell

MR. D. HERBERT asked the Secretary of State for Air whether it has been decided to build a Royal Air Force cadet college at Cranwell and to entrust the work to the Office of Works; and whether there is any reason why the scheme should not be thrown open to public competition, so as to obtain the best possible professional services and greater economy of expenditure through the employment of an independent practising architect?

Mr. Churchill: Yes, Sir. The matter has been very carefully considered, and it has been decided that the most satisfactory and economical results in this case are likely to be obtained by entrusting the work to the Office of Works.

R.A.F. Promotion

SIR W. JOYNSON-HICKS on December 2 asked the Secretary of State for Air whether under the new regulations for the promotion from flying officer to flight-lieutenant a man, aged 22, with five years' service, mostly at the Front, has to wait another two years for his promotion, while a man of three years' service, of which only one year would be at the Front, can be and is promoted flight-lieutenant merely because he is 25; and whether he is aware that this rule is creating serious discontent amongst the younger and most gallant members of the Force?

Mr. Churchill: It was found essential, for the sake of uniformity of practice in the Air Force, to give Air Officers Commanding some guidance in making periodical recommendations for promotion. This was done by means of personal letters to those officers, of which my hon. friend appears to have heard. He has, however, misconstrued the particular direction to which he refers. I should deprecate detailed discussion of the matter, but I might explain that no one will be promoted to flight-lieutenant merely because he is 25 years of age. That age was given as a normal minimum for promotion to the rank, but permission was also given to recommend younger officers whose exceptional service warrants this course. All promotion is by selection, and War-service records are fully considered. There is, therefore, no occasion to fear the anomalies which my hon. friend imagines.

R.N.A.S. Transfers

SIR IVOR PHILLIPS asked the Secretary of State for Air whether men who enlisted in the Royal Naval Air Service in October, 1916, under the Regulations then in force for a period of 12 years' service are held to this 12 years' engagement when transferred to the Royal Air Force, or whether their service under the Air Force Constitution Act is limited to four years; and, if so, whether their four years' service is counted from the date of their joining the Royal Naval Air Service or from the date of their transfer to the Royal Air Force?

Mr. Churchill: Men who enlisted in the Royal Naval Air Service for a period of twelve years' service, and who were subsequently transferred to the Royal Air Force, are held to their twelve years' engagement under Section 3 (1) of the Air Force Constitution Act, 1917. The limitation of service to the period of War or to a period not exceeding four years applies only to personnel attached to the Air Force, and not to personnel transferred.



PERSONALS

Death

Cadet F. D. W. BAYLEY, who was killed in the Macroom ambush, was the son of Mr. G. W. Bayley, of Manchester. He joined the Artists' Rifles in 1916 on leaving school, and got a commission in the Royal Flying Corps and served as a pilot in France for over two years. He was engaged on secret service work, and did a good deal of night flying over Germany. Demobilised in August, 1919, he was articled to the law, but joined the R.I.C. Auxiliary in August last.

Married

CHARLES JOHN RALPH (late R.A.F.) was married on



Fatal Accident in Egypt

THE Air Ministry regrets to announce that an aeroplane on duty in Egypt met with an accident on November 29 which resulted in the deaths of Flying Officer C. O. Rigden and of 295261 Aircraftman A. L. Goodill. Flying Officer S. T. B. Cripps was seriously injured.

The cause of the accident is at present unknown.

December 7, at St. James' Church, Piccadilly, to IRENE, youngest daughter of Mr. and Mrs. WILLIAM M. HEWETSON, of Dudley House, Sutton, Surrey.

ARTHUR EDWARD REYNOLDS (late R.A.F.), of Johannesburg and Shepstone, was married on November 27, 1920, at Saint Paul's, Durban, to PHILLIS MARY, only daughter of HARRY and MARY WOODINGTON, of 16, Leopold Road, Wimbledon.

Captain FRANCIS WHITELEY, late R.A.F., was married on Nov. 5, at the Cathedral Church, Rangoon, to VIOLET BORROW, elder daughter of Lieut.-Col. and Mrs. FRANK JOHNSON.

Killed in Irish Ambush

INCLUDED among the victims of the ambush of R.I.C. auxiliaries at Kilmichael, near Macroom, Co. Cork, on the evening of November 28, were the following ex-R.A.F. officers. Killed: Capt. W. Palester, Cadets W. T. Barnes, D.S.C., F. Taylor, F. D. W. Bayley and J. C. Gleaves. Wounded: Cadet M. F. Forde, M.C.

THE ROYAL AIR FORCE

London Gazette, November 30

Permanent Commissions

Sqdn. Ldr. A. L. Neale, M.C., resigns his permanent commn. as Sqdn. Ldr., with effect from Nov. 30, and is granted a permanent commn. in rank of Flight Lieut., with effect from Dec. 1 (to take precedence next below Flight Lieut. J. R. McCrindle, O.B.E., M.C.).

Stores Branch

The following are granted permanent commns. in ranks stated, with effect from June 17, retaining their seniority in the substantive rank last held prior to grant of this commn.:

Flight Lieut.—W. F. Bryant, T. Fawdry, M.B.E. (substituted for *Gazette*, Nov. 16), G. A. Hilliar.

The following are granted permanent commns. in ranks stated, with effect from dates indicated, retaining their present seniority, and are transferred to stores branch with effect from June 17:—

Flight Lieut.—G. Stevens, O.B.E.; Sept. 16, 1919.

Flying Officers.—A. Holmes; Sept. 16, 1919. T. Thomson; Nov. 11, 1919.

Notifications in *Gazettes* of above dates, appointing these officers to short service commns., are cancelled.

Short Service Commissions

The following officers are granted short service commns. in ranks stated, with effect from dates indicated, retaining their seniority in substantive rank last held by them prior to grant of this commn., except where otherwise stated:—

Sqdn. Ldr.—S. M. Cleverly; Nov. 22.

Flying Officers.—G. W. Pidsley; Nov. 8. R. F. Wallas; Nov. 17. A. R. Wardle; Nov. 17.

Flying Officer (from Pilot Officer)—W. E. Johns; Nov. 23, and with seniority of that date.

Notification in *Gazette*, Sept. 12, 1919, appointing Flying Officer E. P. Dampier to a short service commn. is cancelled.

Flying Officer R. C. Michaelson resigns his short service commn.; Dec. 1. The names of the following officers are as now described, and not as stated in *Gazettes* of dates indicated:—Flying Officer Charles Willie Bragg; July 23. Flying Officer Robert Hugh McCoubrie Sheppard; Sept. 14.

Stores Branch

Flying Officer J. Piggott is granted a short service commn., retaining his present substantive rank and seniority; June 17.

Flying Branch

Flight Lieut. J. A. Barron, from half-pay list (Scale B), to be seconded for duty under the Canadian Air Board; Nov. 27.

Sec. Lieut. to be Lieut.—C. H. Stillwell; April 24, 1918. W. G. L. Bodley (since relinquished commn.); March 19, 1919.

Lieut. L. H. Short, M.C., relinquishes his temp. R.A.F. commn. on appt. to the T.F. Reserve, and is granted the rank of Capt.

Lieut. E. R. Mauley relinquishes his temp. R.A.F. commn. on appt. to the T.F. Reserve, and is permitted to retain his rank.

Sec. Lieut. (Hon. Lieut.) H. S. Gargett relinquishes his temp. R.A.F. commn. on appt. to the T.F. Reserve, and is permitted to retain the rank of Lieut.

Transferred to Unemployed List.—Lieut. W. J. H. Morgan; Jan. 15, 1919. Sec. Lieut. (Hon. Lieut.) C. H. Stewart, M.C.; Jan. 19, 1919. Lieut. E. Stubbs; March 21, 1919. Capt. H. C. Vereker; July 14, 1919. Lieut. H. G. W. Debenham; Sept. 16, 1919. Capt. L. E. R. Murray; Sept. 25, 1919. Lieut.

G. A. Edwards; Oct. 9, 1919. Lieut. P. J. T. Baddiley; Oct. 1. Lieut. A. G. Ellis; Nov. 16.

Lieut. G. E. Tugwell relinquishes his temp. R.A.F. commn., and is permitted to retain his rank.

Sec. Lieut. D. M. Megson relinquishes his temp. R.A.F. commn., and is permitted to retain his rank.

Sec. Lieut. A. M. Broad is ante-dated in his appt. as Sec. Lieut. (A.); Oct. 31, 1918.

Administrative Branch

The name of Lieut. (Hon. Capt.) J. Ramsay, M.C., is as now described, and not as in *Gazette*, Sept. 3.

Technical Branch

Pilot Officer J. W. Brittain to be Flying Officer (Grade A); Dec. 5, 1919 (since demobilised) (substituted for notification in *Gazette*, Oct. 5).

Sec. Lieut. (Hon. Lieut.) A. T. Brogden relinquishes his temp. R.A.F. commn. on appt. to the T.F. Reserve, and is permitted to retain the rank of Lieut.

Transferred to Unemployed List.—Capt. (actg. Maj.) A. B. Murray; Jan. 29, 1919. Capt. A. J. W. Giles; Oct. 9, 1919. Lieut. E. C. Frisby; Oct. 17, 1919. Capt. L. A. Whitby; Jan. 16.

Notification in *Gazette*, Aug. 17, concerning Flying Officer E. P. Dampier, is cancelled. (Notification in *Gazette*, Oct. 1, 1919, to stand.)

Memoranda

One Overseas Cadet granted an hon. commn. as Sec. Lieut., with effect from the date of his demobilisation.

Nine Cadets are granted hon. commns. as Sec. Lieuts., with effect from the date of their demobilisation.

Temp. Hon. Lieut.-Col. W. W. Hardwick relinquishes his hon. R.A.F. commn.; Nov. 13.

London Gazette, December 3

Flying Branch.—Sec. Lieut. J. Rothera (late Gen. List, R.F.C., on prob.) is confirmed in rank as Sec. Lieut. (A.); Nov. 1, 1918. Sec. Lieut. W. A. Sabine relinquishes his temp. R.A.F. commn. on appointment to the T.F., and is permitted to retain his rank.

Transferred to Unemployed List.—Lieut. A. F. Castle; Sept. 16, 1919. Sec. Lieut. F. Coleman; Sept. 17, 1918. Sec. Lieut. S. D. Evans; Oct. 10, 1919. Lieut. S. G. Hollingsworth (May 28) (substituted for *Gazette*, June 14).

Lieut. G. W. Lavington relinquishes his temp. R.A.F. commn.

The notification in *Gazette* Nov. 19 concerning Lieut. R. W. Godfrey is cancelled.

Administrative Branch.—Lieut. E. T. Turner relinquishes his temp. R.A.F. commn. on appointment to the T.F., and is permitted to retain his rank.

Transferred to Unemployed List.—Sec. Lieut. H. B. Clarke; Sept. 13, 1919. Lieut. M. V. Stewart; Sept. 26, 1919.

Sec. Lieut. W. A. Hatchett relinquishes his temp. R.A.F. commn.; Nov. 24.

The Christian names of Lieut. William Roland Henry Wright are as now described, and not as stated in *Gazette*, Oct. 22.

The Christian names of Lieut. William Stephen John Harvey Coney are as now described, and not as stated in *Gazette*, Nov. 9.

Technical Branch

Transferred to Unemployed List.—Sec. Lieut. J. Driscoll; Oct. 11, 1919. Lieut. M. J. Galightly; Dec. 9, 1919 (substituted for notification in *Gazette*, Jan. 6).

Memoranda

Two Cadets are granted honorary commns. as Sec. Lieuts. with effect from the date of their demobilisation.

REVIEWS OF BOOKS

"RIGGING—THE ERECTION AND TRUEING-UP OF AEROPLANES"

IN this little book, which forms No. 1 of FLIGHT Library, Mr. F. W. Halliwell has set out to produce something of real practical use to those who are concerned with the tuning-up and keeping in tune of aeroplanes. He has divided the subject into two parts, first explaining the principles of rigging, and then going on to give examples of their practical application. The method of teaching is progressive, starting with a chapter on the necessity for, and functions of, rigging, which explains the purpose of the various wires, etc., and the reasons why they are placed in the position they occupy. The next step is to describe the actual work of constructing and erecting aeroplanes, and this is followed by a detailed account of the ways and means of adjusting and trueing-up the machine on the aerodrome. In the second section of the book there are complete instructions for carrying-out work of this nature on a number of the most popular and widely-used single-seater and two-seater machines.

The book is the practical outcome of the author's work in the R.A.F., where he was one of the most successful of rigging experts. It is a book which is almost indispensable to the practical ground engineer or mechanic.

It is well illustrated by a large number of very clear sketches as well as several photographs of various types of machines. Bound in blue cloth it is published at 5s., and can be obtained from FLIGHT offices for 5s. 4½d. post free.

FIFTY YEARS OF TRAVEL, BY LAND, WATER AND AIR.

READERS of FLIGHT do not need to be reminded that Mr. Frank Hedges Butler, who, with his daughter and the late Hon. C. S. Rolls, took the initiative in founding the Royal Aero Club in 1901, has other hobbies besides his main one of

being a successful business man. Apparently the singing of Bishop Heber's famous missionary hymn, when a lad at school, fired Mr. Butler with an ambition to see for himself Greenland's icy mountains and the golden sand rolling down from Africa's sunny fountains. In addition he inherited from his father the habit of Pepys. It is to these two facts that we owe this vividly interesting volume of impressions gathered during the last fifty years when rambling on the Continent (especially among the vineyards of France, Spain and Portugal) round the West Indies, through Venezuela, Palestine, India, Ceylon, Morocco, Lapland, East Africa, etc. During the War Mr. Butler paid a good many visits to Rheims, and gives us many vivid pen-pictures of that much bombed and bombarded city. Apart from his actual travels abroad, Mr. Butler includes many reminiscences regarding the introduction of the motor-car into England which will be enjoyed by modern motorists as well as those who are entitled to rank with the pioneers.

The concluding chapters of the book are taken up with accounts of Mr. Butler's one hundred balloon trips and flights in aeroplanes and airships. There are appendices giving a log of the author's balloon ascents, as well as historic facts in connection with the aviation movement in Great Britain.

The book, which is illustrated by a large number of photographs from the author's camera, is published by Fisher Unwin at 21s.

PUBLICATION RECEIVED

Report of the Lubricants and Lubrication Inquiry Committee. Department of Scientific and Industrial Research. Advisory Council. London: H.M. Stationery Office. Price 2s. 6d. nett.

MODEL AEROPLANES

NOTE.—All communications should be addressed to the Model Editor. A stamp should be enclosed for a postal reply

Making Wire Planes

THOSE enthusiasts who prefer to use piano wire for the planes of their models often fail to obtain a true wing because of the difficulty in working piano wire, which is of an extremely springy nature. The best plan is to straighten a length of it before forming the plane; this may be effected by a few dexterous manipulations of the pliers. The full-size plan-form of the wing should be drawn out full-size upon a board

double surfaced. Section as shown herewith. Tail, 12 ins. by 6 ins.; propeller 10½ ins. diameter, pitch 16 ins.

"This model was fitted with twin gear (½ wheels), 4 strands ¼ strip rubber to each. Weight of complete model approximately 7½ ozs. Best duration, 71 secs.

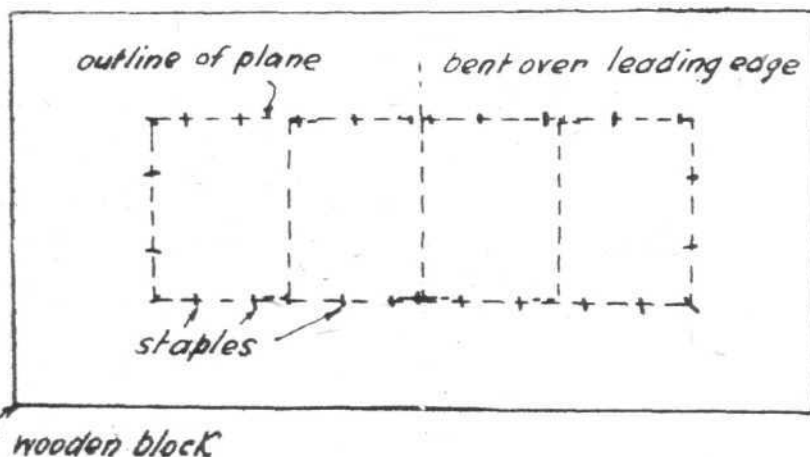
"I first tried the machine with a single surface plane, the average duration being 45 secs. On fitting a double surface of exactly the same area the average duration was 60 secs. The double surface was of course heavier than the single.

Duration, R.O.G. twin propeller pusher. Length (A frame), 3 ft. 3 ins.; plane, bamboo, 3 ft. span, 6½ chord; elevator, bamboo, 15 ins. by 3 ins.; propellers, 11 ins. diameter, 33 ins. pitch; power, 6 strands ¼ strip rubber to each propeller. Average duration, 90 secs. Best duration, 2 mins. The

tractor model gained third prize in the competition it was built for, and the twin pusher holds the Croydon Club record with 96 secs. off ground.

"I should like to form a club for this district. Should therefore be pleased

if you will kindly insert a notice in FLIGHT asking anyone desirous of becoming a member to communicate with D. A. Pavely, 185, Replingham Road, S.W.18.



and staples driven partially home round the pencil-marks representing the outline of the wing. They should be driven home just sufficiently to allow a piece of the piano wire to pass through, as indicated in the drawing. Whilst the edge of the wing is thus held down, lace the ribs into place with florists' binding wire, taking care to ensure that each lies flat upon the board. If it is allowed to cockle the plane will be distorted upon being released. Use Fluxite for the soldering and a medium hard solder. Blowpipe solder is useless, and soon cracks.

With regard to the number of ribs, it is a good plan to divide the span by three-fourths of the chord to obtain the number. Thus a plane 24 ins. by 4 ins. would have eight ribs, one 36 ins. by 5 ins. would have nine, and so on. With rectilinear planes it is advisable to relieve the corners as shown in detail. This prevents the wire being bent at a right angle, and hence the possibility of breakage.

I do not personally recommend piano wire for main planes; I have never traced any better results by using them, and it appears difficult to obtain good stability owing to the plane working in the air; this, of course holds true only for planes above 24 ins. span. I do, however, think it necessary to make elevators and chassis of this material, as well as shafts for propellers.

Eighteen gauge wire should be used for all planes above 24 ins. span, 20 gauge being sufficient for planes less than this in span.

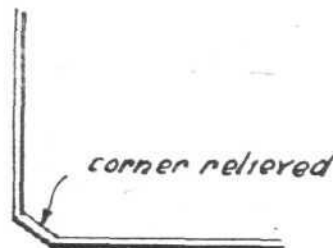
Umbrella ribbing has been tried in conjunction with piano wire for planes, usually as a leading edge, with piano wire for the trailing edge and ribs, the latter being soldered into the channel of the ribbing. In such a wing my experience has been that the leading edge remains quite rigid in the air, but the trailing edge is liable to warp with even the slightest breeze. Umbrella ribbing is also extremely liable to fracture.

Fabric cannot be so neatly attached to wire planes as it can to wooden ones. It is best to sew it to the wire frame, and stiffen the stitches and edge of the fabric with weak glue.

The Pavely Machines

THE following letter from Mr. Pavely will be of interest:—"In answer to a recent enquiry in FLIGHT, I have pleasure in giving particulars of two of my models.

"Single screw R.O.G. tractor monoplane made for the 6-oz. tractor (K.M.A.A.) competition and exhibited at Olympia in 1914. Length, 3 ft. 3 ins.; hollow spar, ⅜ in. by ⅜ in., braced; plane, span 3 ft. 3 ins., chord 3½ ins.,



Pavely Wing Section

The K.M.A.A. Official Notice

At a further meeting of the reorganisation committee of the Kite and Model Aeroplane Association on the 23rd inst., at the hon. secretary's address (as below), several preliminary matters were settled. It was decided that the assistance of aircraft firms and others interested in the movement should be sought with a view to strengthening the resources of the Association. Mr. F. J. Camm made some valuable suggestions, and promised his whole-hearted support. The old rules and regulations were revised, and some will be put into printed form in the course of a few days. Application forms for membership are in the printer's hands, and should be applied for at once to the hon. secretary. The fee for membership is the very nominal one of 10s. per annum, and 5s. for those under 18. The Association has many valuable trophies for competition, and it is the earnest hope of the committee that old members will return to the colours, and that many new ones will accompany them.

Hon. Secretary, J. McBurnie, 172, West Green Road, Tottenham, N.15.

"Model Aeroplaning"

THE second edition of this book, which was first published several years ago, is just to hand. Much useful matter has been added, and the book, from the theoretical standpoint, is quite in order. Many of the blocks, however, are out of date, and do not accurately convey what is the accepted practice of today. One congratulates Mr. Johnson on his meritorious effort to do for model aeroplaning what has already been done for model yachts and locomotives. The publishers share with the author the credit of having produced a book, well printed and representing conscientious endeavour on the part of its author. The book is published by Messrs. Spon and the price is 12s. 6d., or 13s. post free.

SIDE-WINDS

THOSE who have served in the flying services and would like one or more accurate water-colour drawings of machines in flight, aerial engagements, etc., should note that an exhibition of paintings by Mr. Edgar J. March is now open at the gallery of Messrs. Deighton in Trafalgar Square, W.C. Mr. March is prepared to paint any machine or incident if the essential details, such as flight markings, number, colour, etc., are supplied, thus providing a unique and permanent souvenir of service in the R.A.F. The exhibition will remain open for about three weeks.

ONE of the most fascinating of the displays at the recent Advertising Exhibition at the White City was that of the Multiplex Co., of Baldwin's Gardens, Gray's Inn Road, W.C. The Multiplex device for presenting a continuous series of advertisements in colour was the first exhibit which attracted the attention of their Majesties the King and Queen when they visited the exhibition, and they waited to see the whole series through. The latest Multiplex development, a smaller machine, which permits of a set of ordinary double-crown bills being used, also attracted a good deal of interest among business men.

MR. W. H. BARNES, who has been connected with aviation since the very early days—1907, in fact—when he worked on the first Wrights built by Short Bros., has always given most attention to the "engine" side of aviation, which is only natural as he was previously in the motor-trade. His latest venture is a small garage in Colindale Avenue, Hendon, N.W.9, where, under the name of the Cecil Car Repairing Co., he is specialising in the overhauling and rebuilding of cars, while any repairs or adjustments to aero-engines will receive the best attention. Mr. Barnes wishes his old friends of the Eastchurch days and those he met when he was engineer to Mr. H. C. Barber of Valkyrie fame, and later at the Beatty school, would drop in and see him any time they require anything doing to either car or aero-engine.

THE motor-cyclist who is out for absolute reliability and efficiency on his mount, should carefully consider the following interesting item:—47½ per cent. of the plugs fitted to engines at the Olympia Motor-Cycle Show were Lodge plugs. The remainder were divided among twelve other makes of plugs. This, taken in conjunction with the fact that 52 per cent. of the British cars exhibited at the recent Motor Show were fitted with Lodge plugs, is all the more remarkable when it is remembered that they are not the cheapest plugs to buy.

Low Flying Over Crowds

AT Stoke-on-Trent on December 2 Capt. Oscar Philip Jones was summoned for that he, being the pilot of an aeroplane on that day, carried out flying which, by reason of low altitude, was dangerous to the public safety, contrary to the Air Navigation Regulations, 1919, made by the Secretary of State under the Air Navigation Acts.

From the evidence it appears that while a cenotaph was being unveiled by Field-Marshal Sir William Robertson on Armistice Day, Capt. Jones flew over and dropped a wreath. The Air Ministry had drawn the attention of the police to the matter and suggested that proceedings should be taken.

After the Bench had had a brief consultation, the Chairman said they were all agreed that a technical offence had been committed. This was the first case of its kind, and the Bench took into consideration the purpose for which the flight was made, namely, the dropping of flowers as a compliment to and in respect for the proceedings taking place at the time. They were very sorry to have to adjudicate in a case of this kind. They did not think any harm was intended, nor did he think the prosecution would insinuate that, and the Bench had decided to dismiss the case on payment of costs. They hoped it would be a severe warning to the defendant in doing a graceful act on any future occasion.

Mr. Cant said there was another summons against the defendant, namely, for dropping an article other than ballast. Under the Regulations there was an absolute prohibition on the dropping of any material from aircraft other than ballast; but, in view of the decision in the first case, with their Worships' consent, he did not propose to proceed in the matter. The Bench signified their agreement.

The costs of the first case, which the defendant paid, were 6s. 6d.

COMPANY MATTERS

Martinsyde, Ltd.

IN the Companies Winding-Up Court on November 30, Mr. Justice P. O. Lawrence heard a petition by the Brighton Motor Coach Works for a compulsory order against Martinsyde, Ltd.

Mr. Greene, for the respondent company, said that the petition was opposed by practically all the creditors except the petitioners. The company was one of considerable importance, with assets worth at least £440,000. There was a receiver, so the assets were not in jeopardy. It was desirable that time should be given for the reorganisation of the company. It was hoped that it would be put on its legs again, and he asked that the petition should be adjourned.

His Lordship: I will stand it over for a week and I will then want to know what steps have been taken to see if the company can pay the judgment creditors.

NEW COMPANIES REGISTERED

AUTO CONTROLS, LTD.—Capital £30,000, in £1 shares. Manufacturers of stabilisers for aeroplanes, and aircraft of all kinds, etc. Under an agreement with G. Aveline. Solicitor: J. Crisp, 17, Throgmorton Avenue, E.C.

WELSH AVIATION CO., LTD., 31, Fisher Street, Swansea. —Capital £5,000, in £1 shares. Acquiring business of aviation carried on at Swansea by F. G. M. Sparkes and E. A. Sullock. First directors: T. W. Jones, D. Dill, G. Rowe, F. G. M. Sparkes, E. A. Sullock and C. H. Mills.

AERONAUTICAL PATENT SPECIFICATIONS

Abbreviations: cyl. = cylinder; I.C. = internal combustion; m. = motors
APPLIED FOR IN 1919

- Published December 9, 1920.
- 16,671. W. J. GLOVER and C. H. BOOTH. Course-recording instruments. (153,622.)
 - 20,108. G. EREDE. Air-pressure balancing-device for aeroplanes. (153,684.)
 - 21,495. T. R. CAVE-BROWNE-CAVE. Sling or harness suit for use with parachutes. (153,715.)
 - 21,875. BOULTON AND PAUL and J. D. NORTH. Spars, etc. (153,720.)
 - 21,957. F. H. BOWMAN and R. L. ASPDEN. Electrical equipment of aircraft etc. (153,721.)
 - 23,281. O. D. EDMONDS. Direction-indicator. (153,738.)
 - 32,778. BOULTON AND PAUL and J. D. NORTH. Means of attachment of metal ribs to metal spars of aircraft. (153,798.)

APPLIED FOR IN 1920

- Published December 9, 1920.
- 8,313. F. W. CHARLES. Levels and inclinometers. (153,833.)

If you require anything pertaining to aviation, study "FLIGHT's" Buyers' Guide and Trade Directory, which appears in our advertisement pages each week (see pages xv and xvi).

NOTICE TO ADVERTISERS

All Advertisement Copy and Blocks must be delivered at the Offices of "FLIGHT," 36, Great Queen Street, Kingsway, W.C. 2, not later than 12 o'clock on Saturday in each week for the following week's issue.

FLIGHT

The Aircraft Engineer and Airships

36, GREAT QUEEN STREET, KINGSWAY, W.C. 2

Telegraphic address: Trnditur, Westcent, London.

Telephone: Gerrard 1828

SUBSCRIPTION RATES

"FLIGHT" will be forwarded, post free, at the following rates:—

UNITED KINGDOM			ABROAD*		
	s.	d.		s.	d.
3 Months, Post Free..	7	7	3 Months, Post Free..	8	3
6 " " " " " "	15	2	6 " " " " " "	16	6
12 " " " " " "	30	4	12 " " " " " "	33	0

These rates are subject to any alteration found necessary under abnormal conditions and to increases in postage rates.

* European subscriptions must be remitted in British currency.

Cheques and Post Office Orders should be made payable to the Proprietors of "FLIGHT," 36, Great Queen Street, Kingsway, W.C. 2, and crossed London County and Westminster Bank, otherwise no responsibility will be accepted.

Should any difficulty be experienced in procuring "FLIGHT" from local news-vendors, intending readers can obtain each issue direct from the Publishing Office, by forwarding remittance as above.